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GORDON F. FERRIS MEMORIAL ISSUE

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THE PAN-PACIFIC ENTOMOLOGIST

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GORDON FLOYD FERRIS—1893—1958

ROBERT L. USINGER

University of California, Berkeley

For some individuals, a full biography is justifiable only as a matter of record. With Gordon Floyd Ferris the situation is different. Here was a man of originality with much to tell to the world and a gifted pen with which to tell it. In a life devoted to principles as he saw them and to ideals as he conceived them, there emerged a profound truth which, unfortunately, he never put into words. It is that a scientist, endowed with ability and placed in a favorable environment, has an overwhelming obligation to produce for the society that supports him. This obligation, as Ferris saw and filled it in fullest measure, was not necessarily to produce practical results but rather to seek the truth in all things and to make the results known. It happened that some of the work that Ferris did with lice and scale insects was of direct importance to mankind. But he insisted that his interest in these insects had no connection with their actual or potential economic importance. Instead, he was motivated solely by the fact, mystical or otherwise, that he liked them. In a moment of self analysis (Canad. Ent. 56:25, 1924) he wrote on this as follows:

"I have often wondered what it is that determines our special interests. Why does one entomologist prefer to work on dragonflies, another on butterflies and a third on beetles? . . . If we were to study man as we do other animals we would doubtless devise a special terminology to 'explain' these things. We would say that so-and-so is positively hemipterotropic or papiliotropic, or whatever else it may be, and let it go at that with a rather comfortable feeling that we have disposed of the matter! . . . As for myself, I am irresistibly drawn toward the smallest and most intrinsically uninteresting of insect forms. I can appreciate the pleasures of the collector who looks with gloating eyes upon his well-filled cabinet of glorious butterflies or gleaming beetles, but I can not expect him in turn to do more than wonder why I also should look with the same feelings upon a well-filled cabinet of little pieces of glass, each one with one or two minute specks in the centre of it.



GORDON FLOYD FERRIS (1893 - 1958)

But it is so, and my knowledge of ancient languages is not sufficient to enable me to coin a word behind which it is possible to take refuge. I merely know that if an insect is too large to go on a slide I leave it for someone else, and if it is small enough to go on a slide I have an impulse to put it there."

Throughout his life Ferris, who was a large man, maintained this interest in small insects.

Early life. The following quotation is from a brief biographical sketch prepared by Ferris shortly before his death:

"Born January 2, 1893, at Bayard, Allen County, Kansas, a "tank town" where his father was a gandy dancer on the railway. He was the fifth child and the fourth boy in a family of five. When he was between two and three

years old the family moved to a 40-acre farm near Monticello, Cedar County, Missouri, where they lived in a one-room log cabin. When he was a little more than three years old his mother died after giving birth to another son, who also died while still young.

"... He and his sister went to live with his paternal grandmother and an unmarried uncle on a farm near La Harpe, Allen County, Kansas. At the age of about 10 years the grandmother died... His father thereupon moved to La Harpe with the two brothers who had remained with him, obtained employment as a day laborer in a zinc smelter... and... established a "bachelor" home in La Harpe with the two brothers.

"Gordon remained with his father until he was 13, except for two summers spent as a hired hand on a farm near Iola, Kansas. In the meantime his oldest brother, Leslie, ... had enrolled at Ottawa University, a small Baptist college at Ottawa, Kansas, where he acted as the local circulation agent for the *Kansas City Star*. When Gordon graduated from the eighth grade at La Harpe, at the age of 13, Leslie had him come to live with him. With the support of Leslie and such money as Gordon could make by carrying papers... he remained at Ottawa until 1909, having in the meantime graduated from the "academy" at Ottawa University... Leslie graduated from the college in 1909 and secured a position as a teacher in the high school at Telluride, Colorado. He left Gordon as circulation agent for the *Kansas City Star* in Ottawa and Gordon entered Ottawa University as a freshman in the fall of 1909. He was a complete failure at this, withdrew from the college, and proposed joining the Navy as soon as he became 17.

"It was necessary to obtain the consent of his father to join the Navy. The papers were sent to his father, who refused to sign them without first consulting Leslie. Leslie refused to give his consent and instead secured a place for Gordon with the Telluride Power Company at Telluride.

"... In its early days the Telluride Power Company had trouble securing trained men, and under the leadership of L. L. Nunn, its founder, had established the practice of employing young men at reduced salary and after a time sending them to college. Out of this grew the Telluride Association, an endowed institution, entirely apart from the power company... In the spring of 1911 Gordon was transferred to the station of a power company at Olmstead, Utah, where the Telluride Association ran a school for its members.

"The Telluride Association maintained a house at Cornell University, where most of its men who were selected for "preferment" went. Gordon disapproved of the social emphasis at this house and asked instead to be sent to Stanford University. He had seen Kellogg's *American Insects* while he was at Ottawa, and Kellogg—then a professor at Stanford—was the only entomologist he had ever heard of. In the summer of 1912 he was granted \$450 by the Telluride Association and came to Stanford. With the continued support of the Association—never amounting to over \$500 a year—he finished his work for the degree of M.A. in 1917.

"He was then appointed a teaching assistant in entomology at Stanford and further data will be a matter of record."

Field work. To those whose only contact with Ferris was in the laboratory or classroom it will come as a surprise to learn that he was a dedicated field naturalist. He had been at Stanford for only one year when, doubtless through an interest in ectoparasites kindled by Vernon Kellogg and the contact with Joseph Grinnell, he joined a field party of the University of California Museum of Vertebrate Zoology. The trip covered the north coast counties of California. According to C. L. Camp, who was a member of the party, (personal comm.) Ferris' main job was to comb the vertebrates for ectoparasites, but the bound collection of field notes in the MVZ files shows that the 20 year old student's interests ranged widely and his handwriting, which he always deprecated, was already, at that early age, nearly illegible. On July 24, 1913, three miles south of Covelo, Mendocino County, he wrote: "While out hunting butterflies in the afternoon I heard a loud squeak in the oak tree above my head and looked up just in time to see a small wood rat come hastily out of a pile of sticks on a limb and run rapidly down the tree. I could see the folds of a snake in the sticks and upon shooting into them, a large gopher snake, perhaps three and a half feet long, fell to the ground. It lay beneath some sticks and produced a rather loud buzzing sound by beating the tip of its tail against a stick. It escaped into a hole when I attempted to capture it." Two years later Ferris joined another MVZ team and collected ectoparasites from birds and mammals in the Yosemite region.

Other extensive field trips included: Lower California, with J. R. Slevin (1919); Southwestern United States investigating lac-producing scale insects with Roxana S. Ferris (1918) and daughter Beth and C. D. Duncan (1920); Mexico (Guggenheim Grant) (Fall of 1925 to summer of 1926) visiting Sinaloa, Nayarit, the Tres Marias Island, Colima, thence south by foot to Acapulco, the east and west coasts of the Isthmus and Mexico City; Lower California, with Shreve, Mallory and R. S. Ferris, crossing over to Sonora on return (March and April, 1934); Panama including the Volcan de Chiriqui, Puerto Armuellas, David and Boquete (summer of 1938); Arizona, with L. P. Wehrle and R. S. Ferris (1940); China (Fulbright Award) including Yunnan, Hong Kong, and New Territories, Kwangtung and Taiwan (Fall of 1948, spring, 1949). Also Ferris spent a year studying Anoplura at the

Molteno Institute, Cambridge University and at the British Museum (Natural History) (1930-1931).

As in other facets of his life Ferris was unpretentious in his field work. He pointed this up in an unusual article in the *Scientific Monthly* titled "Scientific Exploration, A Phantasy" (Sci. Mon. 27:537-541, 1928). In the story a lone and weary collector pitches camp and falls into a fitful slumber broken by bouts with tropical fever. He dreams of a super expedition supplied by airlift with the most elaborate equipment and the most luxurious food. Being dependent on money in large amounts brought in by public relations men it is finally decided that the scientists, who are merely an impediment, must go. Although facetious, the lone scientist is obviously Ferris and the great expedition could be any one of a number organized in recent years.

Systematics. Ferris was primarily a taxonomist and in this, as in other activities, he brought a fresh approach and a plan for work. Starting with the lice under Kellogg and the Coccidae under Doane he soon set a pattern from which he deviated but little in later years. Foremost was his insistence on detailed drawings—doubtless as a reaction to the shocking state of knowledge of lice and coccids based largely on inadequate descriptions. In his first paper, with Vernon Kellogg, the drawings are not divided by a vertical line into ventral and dorsal halves, but he soon adopted this economical method and gave his philosophy on drawings in 1923 (Sci. 58:266): "A scientific illustration is not intended merely as a pretty picture and it has nothing to do with art. Its purpose is merely to present in the simplest and most accurate manner the things that it is desired to show and its production involves nothing more than good draftsmanship. If in addition to these qualifications it is also artistic—whatever that may mean—so much the better." The arguments for divided drawings were given as follows: 1) they save in cost of blocks; 2) they save in the time of making drawings; 3) they save space in printing; 4) they are more convenient because both sides can be readily compared.

Once started on the course of drawing details of minute insects instead of describing them, Ferris was committed to a compound microscope and pen and ink for the rest of his life. With prodigious energy and usually with several projects running concurrently he turned out monumental works. He provided the foundations for

our present knowledge of the Anoplura, Mallophaga, Coccoidea, Diptera-Pupipara, Cimicidae and Polycetenidae. Probably no man has ever made so many original detailed drawings of insects.

The cost of reproduction of illustrations was a constant problem in his papers which reversed the usual ratio between text and figures. To solve this Ferris turned to off-set lithography in place of conventional letterpress. The result was *Microentomology*, his own journal, in the Foreword (*Microent.* 1:1, 1936) of which he states his "intention to speak as far as is practicable through the medium of illustrations of which the text will be merely explanatory and confirmatory." This emphasis was shown in the papers that we published together on Polycetenidae and Cimicidae. Ferris devoted himself exclusively to the illustrations (which of course could stand alone) and left the text entirely to me.

Although the off-set method reduced costs, the size and number of Ferris' publications raised problems of financing. Curiously, the *Atlas of Scale Insects* was his greatest problem and required the largest outlay of private funds. Here was a work of great economic importance, a standard reference for economic entomologists, yet such was the attitude in support of scientific work before and during World War II that Ferris announced his intention (fortunately not carried out) to abandon the project after Series IV. He reasoned that, "If the world wants this *Atlas of the Scale Insects of North America* completed the world must find some way to pay for it." That the world did find a way to pay for it is no great credit to the "world" because it was only after Ferris had contributed not only the scientific work but also a substantial amount of money that the work was continued. As early as 1919 Ferris wrote an article (*Science*, 50:543): "Why not government-maintained fellowships?" but it took a cold war to bring us to the present level of support for the things that Ferris strove for.

The first and only "book", as distinguished from monographs, atlases, etc., written by Ferris was "*The Principles of Systematic Entomology*" (Stanford University Publications, University Series, Biological Sciences, Vol. 5, No. 3, with reprints bound and sold separately). Here again we see freshness and originality and something else that came to be a trademark. Sometime during the 1920s Ferris developed a style of writing that became stately but not pompous. As a first statement of the principles of a science his

book stands as a classic. The principles stated in this book are sound and were a part of Ferris' own life and work. However, it is necessary to point out that his strongest asset—originality—led to a weakness which will probably not be serious because it can be supplied by later workers. Ferris assumed that all work previous to his own in a group was of dubious value and not worth the trouble to look up. As he put it: (*Microent.* 13(3):52, 1948) "We would seem to be justified in the assumption that a very large part of what was done in the earlier years is likely to be either wrong or inadequate." Continuing (*Microent.* 15(4):127, 1950): "What is to be gained by laborious attempts to disassociate fiction from fact until some basis for judgment has first of all been established? Let us begin with first things first, and proceed then step by step." This, to my knowledge, has been the main basis for criticism of Ferris' work, a small but unnecessary price to have paid for such an original and productive life.

The Plant Quarantine Controversy. Ferris was a fighter in the cause of freedom. He saw in the inspection of personal belongings at the borders of California an infringement of the rights of citizens. This led to a frontal attack on the government agencies dedicated to eradicating the Mediterranean Fruit Fly from Florida. It also led, unfortunately, to personal feuds with friends and colleagues in entomology but the outcome, looking back after 20 years, was beneficial to everyone. Ferris' position was stated as follows (*Science*, 70:452, 1929): "Theoretically, perhaps, the fruit fly can be eradicated [it was!]. Theoretically *any* insect can be eradicated—at a price. A country can be converted into a desert. Its inhabitants can be ruined. It can be depopulated . . . Even should the fruit fly be for the time being 'eradicated'—from a biological point of view a most improbable outcome—at whatever cost, it will inevitably come again [it did!] and the whole performance must again be gone through. Those who believe that any quarantine can guarantee future immunity are leaning upon a hollow reed." In a later article (*Science*, 71:606, 1930) he states that, "It would seem desirable for the supporters of these measures to enlarge the range of their view sufficiently to include a larger proportion of the facts of the situation."

Summarizing his case against the "agricultural bureaucrats" for their "kill or cure policy" and for wasting millions of dollars of the taxpayers' money on what he regarded as an unsound

biological principle, he suggested that a commission be appointed "to consider with a cold and critical eye the whole question of plant quarantines from biological, sociological and legal points of view." This was done and the final report, produced after several years work by a team of highly competent university and government scientists, was reviewed by Ferris with a final comment as follows: "It is a tribute to the intellectual honesty of the members of the committee that the reviewer—an avowed enemy of the quarantine system—can think of no critical phrase to apply to the report more condemnatory than 'unduly cautious'."

Scientific Affiliations. Ferris was not an "organization man" or "joiner", yet he had certain deep seated loyalties. His scientific "home" away from the Stanford campus was the Pacific Coast Entomological Society. He was elected a member of the Society at the 74th meeting on December 13, 1919, at which time he reported on his recently completed trip to Lower California. My first acquaintance with Ferris was at Society meetings in the late 1920s, held in Room 10 of the San Francisco Ferry Building. At first it was a mystery to me why Ferris attended because the meetings were dominated by talk of beetles and butterflies and the philosophy of the long-time president, E. C. Van Dyke. I remember in the depression years sitting on the publication committee of the Pan-Pacific Entomologist when the "hat was passed" to make up each year's deficit. Ferris always contributed what impressed me as large amounts.

The most important part played by Ferris in Society activities was his association with successive generations of students from neighboring universities. Hundreds of students outside his own Stanford group came to know him in this way. Usually, he would bring a folder of drawings and lay them out on a table for inspection. Or, in later years, he would present a controversial point in morphology.

Morphology. Ferris liked to tell this story of his entry into the field of comparative morphology. He was invited to do the chapter on morphology for the book "Biology of Drosophila" as originally planned by A. F. Heutter in 1939 and finally published under the editorship of M. Demerec in 1950. According to Ferris this commitment led him back to the primitive Diptera (Tipulidae), thence to the Mecoptera and finally back to the segmented worms (Annelida). Whether the sequence is literally true, I cannot say,

but this much is certain: Ferris had always been interested in structure as revealed by the techniques used for preservation of his small insects. Then, in the mid-1930s, he was profoundly influenced by the breadth of thinking of a newly formed discussion group in California, the Biosystematists, made up of active students of evolution representing various disciplines in the biological sciences. Thus began another of the major developments in his varied career. Although continuing with the detailed drawings for the "Atlas of Scale Insects" it was clear that his main interest and intellectual challenge was comparative morphology in its broadest sense.

In typical fashion he started with a firm set of principles and with a plan, almost a schedule, for production. Some idea of the scope of his thinking may be obtained from the following quotation: (Microent. 13(3):55-56, 1948) "When—far in the future—we really have a sound and broad knowledge of insect morphology, we shall be able to see, upon the stage of that magnificent theater of biological processes which have produced the greatest of all animal phyla, the Arthropoda, the unfolding and flowering of the processes of evolution with a clarity and degree of detail that can nowhere else be attained."

Characteristically, Ferris found himself almost immediately upon entering the field of morphology, embroiled in controversy. He found the field occupied by static concepts and dominated by principles that he regarded as unsound. Accordingly, he advocated the following methodology for comparative morphologists:

1. Every structure that is present in the organisms with which we are concerned and which is pertinent to our immediate problem must be seen and seen correctly. This implies the search for suitable material; the proper preparation and manipulation of the material; the possession of and the ability to use adequate optical equipment and associated techniques; the training of the eye to see and of the mind to appreciate what is seen; and the rigorous testing and checking of what is believed to have been seen.

2. Every structure which is seen and which can be pertinent to the investigation in hand must be taken into consideration and must be accounted for morphologically. No structure may be dismissed as having no morphological significance until its origin and significance have been carefully explored. Nothing may be dismissed as "merely there."

3. It should be clearly recognized that comparative morphology is not merely the comparison of the end products of evolution. Little is to be gained by the direct comparison of highly specialized forms. These end products must first be related to the less specialized ancestral forms, from which alone an understanding of them is to be derived, before they can be compared with each other.

4. Discrepancies must be accounted for. In attempting to account for them, the first assumption on which to proceed is that there has been an error of observation. The next is that there has been an error of interpretation. And if the discrepancy still persists, it is not to be accepted as representing a condition that may be dismissed. It still remains an unsolved problem that calls for solution.

Ferris maintained that most students of morphology violated these principles either occasionally or consistently. His opponents, in turn, challenged his facts and conclusions. Criticism was especially directed toward his interpretation of the insect head (Manton, S.M. 1949, *Phil. Trans. Royal Soc. London, B, Biol. Sci.* 233:483-580). Ferris replied in a fiery note (*Microent.* 15(4):127, 1950) as follows: "This idea of the adaptational shifting of the mouth is one which could have been tenable in the days of Lankester but which now is about on the intellectual level of a belief in witchcraft. Not until such remnants of folklore have been entirely discarded can the problems of comparative morphology be reduced to a logical basis and a consistent system be developed. They are like believing in ghosts without reflecting upon the source of energy for these ghosts and their manifestations."

The last word has not been said on the Ferris school of comparative morphology but a few generalizations seem to be warranted. First it is clear that statements in the literature on absence of homologies in genitalia, mouthparts, or other obviously comparable structures in insects are naive, unwarranted, or unsound. Whether Ferris, on the other hand, has provided sound interpretations on such subjects can only be determined by time and the work of many investigators. Second, it seems clear that morphological literature contains many errors of observation and interpretation. Whether Ferris, or his students have also erred is a question for future morphologists to determine.

Meanwhile, Ferris has given us six hypotheses which he re-

garded as basic to his philosophy of comparative morphology.

"1. We postulate that evolution has been continuous and orderly, each change being based upon a stage that has gone before. To assume otherwise, to assume that evolution has been discontinuous and has proceeded by steps of great magnitude and unrelated to anything that has gone before, is to surrender at the very beginning any possibility of testing either assumption and of determining whether or not such changes of great magnitude have actually occurred.

"2. We postulate that all evolutionary changes have arisen from changes in the genetic materials and are transmitted only in accord with the laws of genetics, whether those laws are now completely known or not.

"3. We postulate that evolutionary changes are first to be accounted for by modifications of pre-existing structures; by fusions of pre-existing structures; or by loss of pre-existing structures. Only after these possibilities have been exhausted will we assume that a completely new structure has been developed. This is in accord with the principle of parsimony; the validity of the postulate has thus far been substantiated in practice.

"This is a direct reversal of procedures that have frequently been followed by investigators, some of whom, when confronted by a difficulty, have immediately resorted to the assumption that even a whole new system has been evolved to replace a previous system. This has been done time after time and is fatal to the development of any consistent and coherent system of comparative morphology.

"4. We postulate that evolution has not been merely endless change involving all structures of the body. There are structures which have remained stable while everything about them changed. It is these structures which constitute the bases upon which the student of comparative morphology depends for the tracing of continuity. These are the 'landmarks', the importance of which is known as a matter of experience, and search for them is one of the primary activities of comparative morphology.

"5. We postulate the necessity for and the justification of a faith that somewhere in the great mass of material offered to us by the Annulata there will be an answer to any morphological question that may arise. We shall assume that, if the answer is not immediately forthcoming this is most likely due to the lack

of suitable material, a failure to interpret available facts correctly, or the inadequacy of our own mental processes. To begin with the assumption that the answer does not exist is to admit defeat before the matter has been put to a real test.

"6. We postulate that it is not the business of the student of comparative morphology to inquire into the function of a structure. It is his business merely to trace the history of the structure. We are not concerned with whether a leg is used for walking, or for digging, or for leaping, or for grasping, or for swimming. We are concerned only with the question of the morphological origin of that leg and its parts.

"Thus armed with the general principles that have proven valid and useful in the development of other types of scientific investigation, with a methodology, and with a set of at least preliminary hypotheses that are subject to test, we are in a position to proceed. We may pass on to the consideration and the pursuit of individual problems which may offer some answer to the broad question with which we began, that of whether or not the comparative morphology of the Annulata can contribute something to the understanding of the general problem of evolution."

General Characteristics. It is interesting and perhaps useful to consider the characteristics that make for greatness. Foremost among these, perhaps, is motivation or drive coupled with a sense of social responsibility. No less important for a teacher is personal humility, sympathy and generosity to one's fellow men. Then, in a scientist, there is a need for technical competence in his special field, imagination to conceive large works, patience to carry them out and a critical attitude toward his own work and the work of others. Gordon Floyd Ferris had all of these in generous measure.

GORDON FLOYD FERRIS, THE TEACHER

IRA L. WIGGINS

Stanford University, Stanford, California

Gordon Floyd Ferris possessed a rare combination of talents, those of the highly productive research scientist, and at the same time a flair for, and a liking of, teaching that made him an exceedingly valuable member of three different departments during his 42 years of service at Stanford University. He began his career in teaching in the fall of the year in which he obtained his A.B. degree at Stanford, serving as a laboratory assistant in the Department of Entomology and Bionomics during the academic year of 1916-1917. Those who were his superiors in that department are long since gone, but there is little doubt that his performance in the laboratories during his year of work toward the Master's degree was not only satisfactory but well above average, for he was appointed to an instructorship in the Department of Entomology and Bionomics in the autumn of 1917, and served in that capacity until the end of the academic year of 1920-21. During that four year period he was engaged in supervising the laboratory work in the beginning courses in Entomology, with comparatively little opportunity to deliver lectures, that duty being performed by Vernon Kellogg, Professor Rene Doane and other members in the department senior to the young Ferris.

Perhaps it was this initial term of close contact with the students, working with first one and then another on an individual basis as problems in the laboratory were discussed and debated, that gave Gordon Ferris the foundation for such effective work in dealing with his students on a totally informal, person to person basis later in his career. During World War I and for several years immediately afterward, classes in the biological sciences were smaller than now, so one might expect that laboratory sections were then smaller and handled on a more leisurely basis than they are at present, but that assumption is not warranted. There were times when Ferris had supervision of 30 to 35 students in a beginning laboratory and many days found him still in the laboratory at six in the evening, helping the slower students complete their assignments. There were times when he resented the extra effort required, the time taken from the research problems on which he himself was engaged, but he did not shirk his duties

and responsibilities toward the young people in his laboratories. He did comment pungently on the situation at times, however. That he found time for a goodly amount of research is attested by the list of published papers appearing during those early years of his academic endeavors, and by the fact that he completed all requirements for the Master of Arts degree in the spring of 1918.

Even at that time Ferris was developing some of the traits that were to set him apart as an independent and courageous thinker, for he disagreed with two or three other members of the Zoology Department, with which Entomology was merged in 1921. The present writer was first introduced to the Stanford campus and its personnel in the autumn of 1924, three years after Gordon Ferris had been promoted to an Assistant Professorship, but even at that time the students in the departments of Botany and of Zoology (then two separate departments) told their colleagues with great glee the manner in which Ferris stuck to his own viewpoints on controversial subjects and argued vigorously, and usually successfully, with some of his colleagues.

The basis for much of his popularity with the students was the breadth and variety of his reading. He kept up with the literature in entomology to a remarkable degree, and missed little in a number of journals in other fields of zoology as well. This ability to keep his ideas and his arguments up to the minute served him well in his classes, for he quoted from the current research papers, brought new ideas to the laboratory, and discussed many of these papers frankly, often critically with the students. He was, neither then nor later, at all hesitant about approaching a particular paper critically and objectively. If it seemed to him to be well written, based on sound investigative work, and accurate in its conclusion, he praised it; if he detected carelessness or unsupported statements, he quickly pointed to the defects and many times made constructive suggestions for overcoming the deficiencies apparent to him.

Nor was he content to teach his courses, do his laboratory research, and read widely in scientific and non-scientific fields. He spent weeks and months in the field, collecting insects of many kinds, but principally scale insects and lice, for he began to specialize in these two major groups comparatively early in his career. Early in the 1920s he made huge collections of both lice and scale insects in México, walking many long weary miles with his meager field equipment packed on one burro and accompanied

by a timid peon often greatly in fear of his life from "bandits" or "tigers." After each such field trip his lectures and his discussions during laboratory sessions were enriched by his experiences in such a way that the students gained a broader, deeper interest in entomology than they would had he confined his remarks to elaborations of the text or matter-of-fact consideration of dissections or drawings of various types of arthropods. Often he could associate a particular species of insect with a precise spot where it, or a close relative, had been encountered in the field. By bringing this type of personal touch into the classroom he enlivened and vitalized the subject for the students, often leading members of a class to elect entomology as a college major without suggesting such a course verbally.

It would be a mistake to assume that because Ferris kept members of his classes intensely interested in the subject that he was an easy taskmaster. He required conscientious work, close attention to detail, and a high degree of accomplishment in executing drawings or preparing insects for insertion into a collection. He was an excellent draftsman and experimented extensively with techniques for depicting insects accurately and yet with a minimum of time and effort. He was among the first to admit that all students were not equal in ability with a pencil or an inking pen, so did not insist that each acquire excellency as a draftsman, but he did insist that every member of his class could and should learn to make recognizable drawings that were accurate as to outline and scale. He was incensed by carelessness and by "fuzzy thinking." He wanted, and obtained, reasonably clear-cut English in examination papers and written reports if those exercises were to obtain good grades or his support when a candidate was seeking a position. He held high standards for his own professional achievement, and expected each student to strive diligently and constantly for improvement—not necessarily for perfection. He was well aware that the latter goal is rarely—if ever—attained.

He served as Assistant Professor from 1921 until 1927, and became Associate Professor with the beginning of the academic year of 1927-28. He remained at that grade for ten years, and was promoted to a full professorship in 1937. During all of these years his teaching activities claimed approximately one-half of his time, or during some years, more than that proportion of each working week. He taught general entomology, a course in histology and

microtechnique for several years, classification of insects, a specialized course on aphids, one on economic entomology with special emphasis on Coccidae, principles of nomenclature, and year after year supervised the advanced training of several graduate students working toward the Masters or Ph.D. degrees. He was a cooperative member of the department, and when the departments of Botany and Zoology were merged in 1934, and together with the course in General Biology constituted the Department of Biological Sciences, he accepted greater responsibility for course work in Entomology, and took over supervision of several sections of the General Biology laboratories.

With the passing of the years his penchant for philosophical contemplation of biology and biological activities increased and he developed advanced courses in the principles of classification, turned his attention to the internal anatomy of insects with the conviction that such studies could help solve some of the problems involved in the evolution of insects and provide stimulating teaching material. When other members of the department accepted appointments elsewhere and temporarily left the Department of Biological Sciences short of offerings in elective courses for upper division students, he accepted the responsibility for keeping such offerings available. In one such situation he developed a course in the philosophy and developments of the concepts associated with evolution and was pleased greatly that it gained a high degree of popularity, was greatly chagrined when his failing health necessitated its termination.

When Professor Doane retired and Ferris was the sole remaining entomologist in the Department of Biological Sciences, he accepted even heavier teaching burdens by giving some courses in alternate years, by reducing the time he could spend on his own research, and by almost eliminating recreational activities in the field of yachting and serving as a leader of a Sea Scout Ship. Thus, with the flight of time his teaching activities took a larger proportion of his time, his thought, and his energy, but these inroads on his time for research and extracurricular activities prompted very little protesting and no serious grumbling on his part. He saw the need for courses for the training of biology majors in certain aspects of entomology, and he filled those needs in a whole-hearted, public-spirited manner.

Among the courses he gave after Doane's retirement was the

one Professor Doane had taught for a number of years in economic entomology, entitled, "Insects and Man" and known among the students as "Bugs and Bites" after Ferris assumed responsibility for it. No doubt his personal interest in the biting and sucking lice led him to emphasize the importance of these ectoparasites and partially set the tenor of the course. Be that as it may, the course was one of the more popular elective courses offered within the Department of Biological Sciences, despite the fact that it was a lecture course and one that required considerable reading from sources outside the text. He organized the material presented in such a way that the course could be taken without prerequisites, and many students at Stanford University had little or no other contact with college biology courses. To Ferris this placed a heavy responsibility on his shoulders, and he insisted on giving the course for several years after his health had begun to fail, and when the thrice-each-week lectures exacted a tremendous toll of his strength. Nor was this course considered a "pipe" by the students who elected it. Rather, they recognized it as an opportunity to become acquainted with a great teacher who, incidentally to them, was interested primarily in insects.

In this course as well as in his advanced ones, he drew from his rich experience while doing field work as a Guggenheim Fellow in México during 1925-26, a year spent at the Molteno Institute in England in 1930 and 1931, while on an extended expedition into Lower California and Panama in 1938; and late in his teaching career, from nearly a year spent in China as a Fulbright Fellow in 1948-49. When he described the malarial menace in the tropics, he had personal knowledge of the disease and its vectors, for he had suffered severely from malaria after his Mexican Trip in 1926. He had seen natives of several countries existing under the burdens of numerous ecto- and endoparasites and gave graphic and accurate word pictures of his observations. Apparently, Gordon Ferris saw little in the world of insects that he was unable to utilize in his teaching.

One of the striking characteristics of many of his lectures was the absence of notes when he confronted his classes. His ability to organize such a tremendous amount of information in his mind, and present it logically, interestingly, and with a personal slant without notes was a constant stimulus and source of admiration among his students. Not that he was oratorical in his presentation

—he was not. He presented the subject informally, in a rather high-pitched voice, but with such obvious personal interest in what he had to share, that his listeners remembered what he said long after they would have forgotten flights of rhetoric. Ferris did, however, have the ability to coin apt phrases that caught the attention of his audience and helped to impress them with the worth of his offerings. Perhaps, though, the greatest advantage he possessed was the ability to make his students or the members of an audience feel that they were sharing his experiences and his enthusiasm with him.

Important as his contributions to the intellectual life of the undergraduates who took his courses in entomology or related subjects were, his greatest service in teaching was among his own and other faculty members' graduate students. His technique in handling such instruction was almost wholly that of the informal conference. During such conferences he usually smoked incessantly, lighting one cigarette from the butt of the previous one. The student often had to supply the match with which to light the first one, and not infrequently, the subsequent cigarettes. The conference might last ten minutes, or it could continue for hours. Many, many times the discussion involving the student's research work, his problems in other courses, or general philosophical questions with numerous ramifications, would be interrupted long enough for them to drive to the Ferris home where the discussion could continue through the evening meal and well into the night. On such occasions the student was made to feel at ease and was given encouragement if that seemed to be called for. He could be, and sometimes was, subjected to rigorous verbal chastisement. But always he was urged to think his own thoughts, to approach every question as objectively as possible, and to keep an open, independent mind.

Several times each day Ferris would lay aside his pencil, his pen, or his dissecting needles, stroll into the cubicle of one of the graduate students, chat with him for a few minutes about the work that the student was doing or about a particular research project in which Ferris himself was engaged. These little interchanges, totally unscheduled and delightfully informal served to keep the graduate students aware of Ferris' work as well as to stimulate them to extended efforts toward solving their own problems. One of the results of such a practice was that many students who

would otherwise have become discouraged and dropped out of the struggle toward an advanced degree, continued on to either the Masters or Doctors degree—and some to both. He did not pamper his students, but he brought out their better qualities, often helped them find unexpected capacities, and won their life-long loyalty and respect.

Particularly during the years following World War II, candidates for the Ph.D. degree were encountering difficulties in passing the language examinations. Ferris decided that much of this difficulty stemmed from the lack of concerted, continuous effort toward really understanding the language involved, and in lack of practice in reading papers in a foreign tongue. To remedy the situation he organized a seminar in the reading of scientific German. For nearly ten years he met with any and all graduate students interested in biology who needed practice in reading German, but who could not arrange their schedules so as to take regular courses offered in the Department of Germanic and Romanic Languages. He spent from two to four hours per week in this service. He was not obliged to carry this burden, nor did he receive compensation for the time and effort expended. He received great satisfaction, however, from the knowledge that shortly after this seminar was instituted, there was a marked increase in the number of candidates who passed the examination in reading German—given by another member of the Department—on the first trial. Throughout the period of this seminar the often mentioned but seldom practiced scheme of running a university by having the “student on one end of the log and the professor on the other” was followed, for Ferris and the members of his seminar group tackled each reading assignment together, puzzled over German syntax and idioms, and struggled with complex German sentences. On rare occasions they had to consult a member of the instructional staff in German, but as time passed such consultations became less and less frequent, for Ferris’ own command of the language improved with the repeated seminar sessions. This seminar, like his informal chats with candidates for advanced degrees, gave encouraging aid to a number of students who otherwise might have abandoned their efforts to secure training beyond the A.B. and kept them striving until the goal was finally attained. He can be credited personally with having applied the stimulus and the aid necessary to carry several students through

to one or the other of the advanced degrees so necessary for their professional improvement.

The full extent of Gordon Ferris' influence on modern entomology and contemporary entomologists is difficult to estimate. Some indication of the esteem in which his colleagues held him and his work is found in letters from workers living in many parts of the world. Many of them asked for professional advice or for opinions bearing on the writer's entomological problems. Their general spirit is that of men who recognized Ferris as an authority in his field, one whom they respected and whose opinions they could trust.

Another key to the scope of his influence is reflected in the number of graduate students who worked with him toward M.A. and Ph.D. degrees. Forty-five of his candidates successfully met the requirements for the M.A. and at least 19 individuals earned the Ph.D. under his supervision. The late P. N. (Perk) Annand, for a number of years Chief of the U. S. Bureau of Entomology and Plant Quarantine, was the first Stanford student to complete the requirements for the Ph.D. degree under Ferris' direction.

Among the other men and women who have obtained advanced degrees with Ferris' guidance, some have continued in teaching and research in various colleges and universities, some have found employment with state and federal agencies, a number entered teaching positions in high schools and junior colleges, a few have accepted positions involving applied entomology or basic research with industrial concerns. Their impact on entomology and entomologists continues the philosophy and spirit of independence that Gordon Ferris so ably represented.

Still another group of scholars entered Ferris' laboratory for specialized or advanced training and experience. Entomologists who had previously obtained advanced degrees came from various parts of the United States and from abroad to work with him; to learn at first hand his techniques in preparing and illustrating insects; to collaborate with him in particular research problems or to absorb the highly regarded brand of tolerance, and paradoxically some of the intolerances, that characterized the atmosphere in his laboratory and in his classrooms. Ferris himself would probably have been one of the first to disclaim any idea that he had a "mission" to teach these visitors anything special, or even that he felt he was teaching many of them anything at all. He

just gave each of them generously of his time and an opportunity to discuss many subjects during the course of the days spent with him. Each became, for varying periods, a guest in his home. To many of them the social hours there were as much of an education as were the days spent in the laboratory and in the field collecting specimens. Thus, Ferris came to know and respect entomologists scattered through many parts of the world, and they, in turn, highly regarded him. For years he kept up a terse correspondence with scores of them, and through this correspondence, liberally larded with flashes of beautiful phraseology, continued his influence in the field of entomology.

Ferris experimented with numerous approaches and methods in carrying on his teaching activities. Discussion in small groups was his forte but was by no means the only teaching technique he mastered. He assigned specific problems to individuals or to small groups in connection with laboratory courses, or placed material in the laboratory with general instructions to find out as much as possible by observing the organisms provided. Such an assignment did not mean neglect during several laboratory periods; rather, frequent but brief inspections of progress were made, with hints—rarely more than hints—about promising lines of attack or sources of information. His ability to keep in mind the respective tasks assigned to different members of a class, and his facility in picking up or temporarily dropping his own research at these frequent interruptions permitted him to accomplish large tasks under conditions that would have appalled many who demand protracted periods of uninterrupted concentration in order to get anything done. The knowledge that he was doing important research at the same time he was conducting his classes gave him stature in the eyes of the students, so he was held in high repute by them, equally as a research scientist and as an outstanding teacher.

In one of his advanced courses particularly, that in the Philosophy of Biology, Gordon Ferris utilized a technique that brought to his audience not only his own philosophy but laid behind it a background of the thinking and writing of many others. During part of almost every class period he would read aloud from the writings of both modern and older biologists until he had covered a particular point or series of ideas, then spend the time remaining to expound his own views about the passage read. In that way

he presented each "lecture" with a freshness of outlook and full familiarity with the subject that was most stimulating to the class.

A streak of impishness that came to the surface at unexpected times was a source of amusement to many and of embarrassment to others when they were the object of his teasing. Those with a well developed sense of humor usually could detect the approach of one of his sly digs or near-shocking comments, but to the overly serious or the person who sees little of humor if he is the butt of a joke, these incidents were always a surprise. He used the Theory of Evolution to lampoon pomposity by referring to the comparatively few generations that separate men from monkeys. From time to time he expressed skepticism about the immaculate conception or other aspects of Christian theology. Such deprecating statements were more often than not delivered when some member of a religious order was present in his class. At first such individuals were genuinely shocked and at times outraged, but usually more prolonged acquaintance with the man and his deep human sympathy revealed that his chief object was not to destroy another's faith, but only an effort to get his students to think for themselves and to approach questions objectively and open-mindedly.

Ferris believed that every human individual should be himself, think his own thoughts, find his own satisfactions in such manner as to do so without violating the dignity and rights of others, and determine his own philosophy and mode of life. He did not encourage conformity for the mere sake of conforming. He did not favor mediocrity through compliance of all members of society to the "norm" of that society. Often he astonished students seeking advice by hearing only part of the details of a tangled situation and then telling the man or woman to think out what he or she thought was the right thing to do and then go do it, regardless of what others might think. One may consider this type of advice dangerous, but he did not—provided one always tried to avoid harming another individual in the exercise of his own freedom. He advocated direct action, although not violent action. He managed to bring so much of his personal philosophy and convictions into his lectures and the discussions he held with smaller groups that no one could justly accuse him of neglecting the humanistic side of his science or his obligations as a citizen in his community.

Even in the discharge of his duties as a citizen he continued to teach effectively and apparently effortlessly. For a number of

years he was active with the Sea Scouts, and every Scout in his Ship learned a great deal about navigation, the rules of the sea, small boat handling and repairs, and other phases of Sea Scouting. But they also learned much about human relations, the place of the individual in the community, self-reliance, and numerous other traits and attributes of an American citizen. At one time he had the son of a city official and one of a Chinese restaurant proprietor in his Ship. The offspring of the city official had a bullying streak that did little to endear him to his associates. After being the subject of much heckling from the other, the Chinese boy turned on his tormentor and with a totally unexpected ferocity gave him a thorough trouncing. Ferris had seen the direction the squabble was taking and conveniently had an errand to perform elsewhere just before the argument reached the physical combat stage.

Obviously, his lessons were by no means confined to the classroom or the laboratory, and those dealing with Entomology were only a part of his genuine contribution to the total fund of knowledge obtained by the men and women, the boys and girls, with whom he lived and worked. Others might advocate teaching school children the art of getting along together, of social adjustment, even if the subject matter of scholastic endeavor were neglected, but not Ferris. He believed that sound study habits and a solid core of fundamental factual knowledge came first, that the social graces, if they were to be learned at all, should be learned at places other than in the classroom. Some of the "social graces" impressed him not one whit, although there was no more gracious host or companion within the membership of his department. He practiced what he preached in that he lived his own life according to his own lights and beliefs. He tried to avoid infringing on the rights of others while following his own modes of living, but he reserved unto himself the right to determine what his line of actions should be.

Gordon Ferris was so intensely aware of his obligation as a teacher that he made personal sacrifices that seemed, to some of his friends, unreasonable. For example, he took sabbatical leave only three times during the 42 years he served on the teaching and research staff of Stanford University, once to do arduous field work in México, once to spend a year at the Molteno Institute (in 1930-31-) in England, and once to spend nearly a year (1948-49) under a Fulbright Fellowship in China. Summer after

summer, when he was under no legal or moral obligation to remain on campus he spent practically every week day in his office-laboratory in order to be available to graduate students trying to complete requirements for advanced degrees. He received no additional remuneration nor academic preferment from such extra services, but was content to know that his students were benefitting from his presence. He refused to accept a flattering fellowship which would have permitted him to do field work and research simply because he felt obligated to teach his courses.

That such generous devotion to other's needs made deep impressions on the students whom he helped and befriended has been attested by scores of letters addressed to Mrs. Ferris, to other graduate students, and to the writer of this paper after the news of his death had been circulated. Typical of the eulogistic, but wholly sincere tributes are a few that read "To me Ferry's value as a teacher was not so much in the field of didactic instruction but rather as a living example. He lived in strict accordance with his principles. He was intellectually honest. He was honest with himself, his colleagues, and his students." Another writes: "I have been, and always will be, proud to be known as one of Professor Ferris' students." From another: "It has been said that the influence of a teacher never ends. In my courses in biology, Ferry will always be the most important influence. In the day-to-day practice of biology, things he said long ago, continue to guide me. Ferry had a strong and infectious spirit of radicalism about scientific 'authority' that I hope I never let down." And from a student whose major interests were in a segment of biology quite removed from entomology came this: "You must know that your loss is shared by every student who has worked in the Museum . . . I regarded Professor Ferris as a personal friend. He helped me many times with problems in my work and what was much more important, he was interested in what I was doing and what I was thinking . . . I took two formal courses from Professor Ferris . . . in which he didn't teach us about insects, but instead taught us to observe, to accurately record our observations and to trust nature, not books." Finally, another student wrote: ". . . please remember that the instructions he gave at the University and his spirit as a scientist may survive at least in one of his students. After all, Professor Ferris was the greatest teacher for me."

GORDON FLOYD FERRIS AS A STUDENT OF THE
SCALE INSECTS

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The passing of Gordon Floyd Ferris on May 21, 1958, brought to a close the career of one of the most versatile Coccidologists of our time. It is evident that the things which can be properly said about Professor Ferris with respect to his work on scale insects involve the man and his approach to entomology rather than any special relationship with coccids as a group. He approached anything he undertook with a singleness of purpose, and an energy drive that was probably unmatched in any other entomologist I have ever known, and he worked with marked efficiency on any group which kindled his interest. In the scale insects he was productive in describing new taxonomic units, and in developing and publishing new terminology and new ideas about their morphology and classification. It is generally felt that most of his work on scale insects will stand indefinitely, though some of his proposals on the classification will doubtless be modified as new forms are discovered and others are studied more critically.

Professor Ferris helped and encouraged many contemporary and younger workers, both in this country and abroad, a few of which include A. S. Balachowsky, G. De Lotto, W. J. Hall, Raymond Mamet, V. P. Rao, J. B. Steinweden, D. J. Williams, and the writer. In this respect he was most generous and hospitable in receiving fellow scientists into his laboratory and home in Palo Alto, making available his collection and library, and in lending valuable specimens for study. His uppermost thought was sharing his findings to advance the scientific knowledge of Coccoidea. His correspondence was world-wide, and he remained in touch with Coccidologists in many countries by prompt and generous exchange of specimens and helpful notations.

The attitudes of several foreign workers on scale insects about Professor Ferris are abstracted as follows from certain letters received after his death.

D. J. Williams, London, England, May 28, 1958:

I remember his welcome help when I first took up the study of the Coccoidea and since then he has given every assistance which, I understand, was his way with everyone.

His works have always been a source of encouragement and his wit often enlivened our subject. We will, no doubt, remember that he made life easier for us and that he has set us a standard which we feel bound to try and follow.

I am sorry that I never met him, but to you it will be a great personal loss.

Raymont Mamet, Mauritius Island, Indian Ocean, June 2, 1958:

The work of Professor Ferris on the Coccoidea and other insects will last for very many decades and we who have known him will always remember his simple and kind manners.

A. S. Balachowsky, Paris, France, June 2, 1958:

I was extremely pained to know that Dr. Ferris died from his heart disease May 21 last. It was a very great loss for the world's science. He was the most famous coccidologist of any time. He had had a very strong and original personality and contributed to establish coccidology on a modern level.

W. J. Hall, London, England, May 28, 1958:

His loss will be deeply felt by entomologists the whole world over and in particular by Coccidologists. No one has done more to advance our knowledge of the Coccids than Professor Ferris, and his work in this field will remain a tribute to his memory for many years to come. But he also made great contributions to other aspects of the subject, and by his passing we have lost an outstanding entomologist of world-wide repute.

Something should be said about Professor Ferris' ideas on scientific illustration or, as he preferred to call it, "entomological drafting." He felt that the average worker should content himself with good draftsmanship. That is, to record with severely simple means, and with utmost accuracy, what he sees. In Professor Ferris' opinion, there is no excuse for sloppiness in entomological illustration. He believed that accuracy and exquisite care are essential in entomology as in the field of mechanical design.

One of the most practical compromises he made in coccid delineation was that of the divided drawing which shows one half of the dorsal and one half of the ventral side of the insect. Such drawings are possible because these insects are bilaterally symmetrical. Even though divided drawings were used as early as 1904 by J. G. Sanders, in his work on Coccidae of Ohio, I., we can credit Professor Ferris with a considerable role in applying the method, not only to the Coccoidea but also to a number of other insect groups. He developed this technique to its present

state of outstanding utility, including the precision of detail demanded by the highest standards of work. Professor Ferris' brilliantly executed illustrations have gained for him the unquestioned reputation of being the world's foremost illustrator of Coccoidea.

The first publication of Professor Ferris on scale insects was done in 1916, as a junior author, with Professor R. W. Doane. It included the descriptions of three new species of Samoan scale insects, and the excellence of Ferris' drawings of these insects will be noted in this first article.

In 1918, he produced his first rather extensive paper on Coccoidea, "The California Species of Mealybugs," published in the Leland Stanford Junior University Publications, University Series.

The period from 1918-1935 was marked by the publication of a wide variety of papers on scale insects, among which were a series of 11 articles on "Notes on Coccidae (Hemiptera)" appearing in various numbers of the Canadian Entomologist. During this period other of his outstanding papers on scale insects appeared mostly in the Stanford University Publications, University Series, Biological Sciences, and several book reviews on scale insect works by other authors were published in certain numbers of Canadian Entomologist and Entomological News.

During 1936, and until the time of his death, Professor Ferris made tremendous strides in developing the taxonomy of Coccoidea.

The publication "*Microentomology*" was founded by him in 1935, and, as has already been pointed out by Dr. Ira Wiggins in a Memorial Number of that same Journal (vol. 23, pt. 2, p. 71, 1958), he "edited each number, contributed many important papers to its pages, and, more frequently than he really could afford, gave financial support to insure its publication."

Many issues of *Microentomology* were devoted to clarification of generic types, particularly of the armored scale insects (Diaspididae). In this regard, Professor Ferris records the following in one of the earlier issues of this journal:

It is sufficient to say that the student of the Coccoidea is presented with two alternatives. On the one hand he may cling to the admittedly inadequate system of an earlier day and on the other he is forced to wander in a maze of generic names the application of most of which can not be determined from the existing literature. We are thus at the moment in something of an impasse in the study

of this group. But the way of escape is evident, though laborious. The first step is to examine critically and illustrate adequately the types of the named genera so that students may have some basis for forming their own conclusions as to the characters which are available for the recognition of generic groups.

This he did in his inimitable manner, and these works have been the basis for critical world-wide revisions of many of these scale groups.

Less than a year before his death, Professor Ferris published in *Microentomology*, "A Brief History of the Study of the Coccoidea." His comments regarding certain workers on scale insects are quite critical, although justifiably so. The introduction expresses his feelings regarding the high quality work he believed necessary in Coccoidea taxonomic research. He comments:

The author can quite truthfully say "much of this I saw and some of it I was." In writing this history toward the end of his life when there is no longer anything to be gained by undue avoidance of objectivity or of undue consideration for the feelings of others, the writer feels it incumbent upon him to express the truth as he feels it to be. Such truth requires a severe judgment upon various men who have been in the past or still are his colleagues. His estimates of the work done by some of his predecessors, and even by some of his colleagues is extremely unfavorable, but they are estimates made as honestly and sincerely as possible. For that he begs no one's pardon.

Perhaps the most outstanding contribution on scale insect taxonomy which the world has ever known, is his monumental treatise entitled "Atlas of the Scale Insects of North America." The first four volumes of this Atlas, published during 1937-1942, were devoted to a comprehensive treatment of some 245 species of armored scale insects (Diaspididae), all of which were magnificently illustrated by Professor Ferris. Volumes V and VI of the Atlas, published in 1950 and 1953 respectively, included the systematics of the mealybugs (Pseudococcidae) of North America. In these two volumes 206 species and 38 genera of mealybugs were considered, and beautifully delineated by Professor Ferris. Volume VII of the Atlas, published in 1955, dealt with the Coccoidea families, Acleridae, Asterolecaniidae, Conchaspidae, Dactylopiidae, and Lacciferidae. In this volume taxonomic treatments for 168 coccids in 21 genera, together with keys to all, were presented.

BIBLIOGRAPHY OF GORDON F. FERRIS

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A bibliography of the scientific papers of the late Gordon F. Ferris appeared in *Microentomology*, Volume 23, Part 2, pages 75-80; September 26, 1958. The present one adds some titles; nearly all have been checked with the original sources. Attention was paid to the actual dates of publication whenever they could be verified, and some changes in the sequence of titles have resulted.

I am indebted to Dr. Ira Wiggins and Dr. Laura Henry for supplying me with lists of most of the papers by G. F. Ferris.

It is difficult to know how to list the numerous cases in which Professor Ferris' (paraphrased?) remarks at meetings of the Pacific Coast Entomological Society appear in the published Minutes. There is hardly a doubt that the information therein should be attributed to him, rather than to the persons who recorded and signed the minutes, and I am sure the recorders would have been the first to agree to this. Since all appeared as untitled notes in The Proceedings of the Society, they are given below as a unit, with my explanatory comments in brackets.

It should be noted that some of the Minutes which concern us (those of the 71st to 116th meetings) are in the two volumes of separately published Proceedings, and cannot be dated exactly. For details see the summary by J. W. MacSwain in the Pan-Pacific Entomologist for 1951 (27(3):105-109). The remainder are in the Proceedings, published annually in the Pan-Pacific Entomologist.

It is quite possible that Professor Ferris has been similarly reported in the minutes of other entomological societies, but there has not been an opportunity to make the necessary search.

1915

1. (Junior author with V. L. Kellogg) Anoplura and Mallophaga from Zululand. Annals of the Durban Museum, 1(2):147-158; pls. XV-XVI. Published May 15.
2. (Junior author with V. L. Kellogg) The Anoplura and Mallophaga of North American mammals. Leland Stanford Junior University Publications, University Series. 74 pp.; 18 figs., pls. 1-8. Published May 25.

1916

3. (Junior author with R. W. Doane) Notes on Samoan Coccidae with descriptions of three new species. Bulletin of Entomological Research 6(4):399-402; figs. 1-3. Published in January.
4. Mallophaga and Anoplura from South Africa with list of mammalian hosts of African species. Annals of the Durban Museum, 1(3):230-252; figs. 16-27. Published April 20.
5. Cervophthirius crassicornis (N.) (Anoplura). Entomological News, 27(5):197-200; 1 fig. Published May 2.
6. A catalogue and host list of the Anoplura. Proceedings of the California Academy of Sciences (Fourth Series), 6(6):129-213. Published May 12.
7. Notes on Anoplura and Mallophaga, from mammals, with descriptions of four new species and a new variety of Anoplura. Psyche, 23(4):97-120; figs. 1-12. August number.
8. Some generic groups in the mallophagan family Menoponidae. Canadian Entomologist, 48(9):301-311; figs. 10-15. Published September 15.
9. Anoplura from sea-lions of the Pacific Ocean. Entomological News, 27(8):366-370; figs. 1-4. Published September 30.
10. Some ectoparasites of bats (Dipt.). Entomological News, 27(10):433-438; pls. XXII-XXIII. Published December 6.

1917

11. Methods for the study of mealy-bugs. Journal of Economic Entomology, 10(3):321-324. Published June 19.
12. A new genus and species of Coccidae (Hemip.-Homop.). Canadian Entomologist, 49(11):375-378; figs. 36-39. Published November 1.

1918

13. A note on the occurrence of abdominal spiracles in the Coccidae (Hemiptera). Canadian Entomologist, 50(3):85-88. Published March 15.
14. An apparently new species of Leptinillus (Coleoptera, Leptinidae). Canadian Entomologist, 50(4):125-128; figs. 4-6. Published April 13.

15. Notes on Coccidae (Hemiptera). Canadian Entomologist, 50(7):221-225; pl. IV. Published July 10.
16. The California species of mealybugs. Leland Stanford Junior University Publications, University Series. 78 pp.; 16 text figs., pls. I-III. (Received at the California Academy of Sciences Library on July 24.)
17. Notes on Coccidae II (Hemiptera). Canadian Entomologist, 50(10):323-332; figs. 12-16. Published October 10.
18. The alleged occurrence of a seasonal dimorphism in the females of certain species of mealy bugs (Hemiptera; Coccidae). Entomological News, 29(9):349-352. Published November 2.

1919

19. A remarkable case of longevity in insects (Hem., Hom.), Entomological News, 30(1):27-28. Published January 4.
20. Two species of Phylloxera from California (Hemiptera; Aphidae). Entomological News, 30(4):103-105; text figs. A-D. Published April 3.
21. A contribution to the knowledge of the Coccidae of southwestern United States. Leland Stanford Junior University Publications, University Series. 68 pp.; figs. 1-38. (Received at the California Academy of Sciences Library on May 17.)
22. Notes on Coccidae—III (Hemiptera). Canadian Entomologist, 51(5):108-113; figs. 17-19. Published May 20.
23. Observations on some mealy-bugs (Hemiptera; Coccidae). Journal of Economic Entomology, 12(4):292-299; figs. 15-17. (Received at the California Academy of Sciences Library August 27.)
24. Lac-producing insects in the United States (Hemiptera; Coccidae). Journal of Economic Entomology, 12(4):330-333. (Date of receipt as for previous item.)
25. Anoplura of the Canadian Arctic Expedition, 1913-18. Report of the Canadian Arctic Expedition 1913-18. Vol. 3, Part D:11d.
26. Notes on Coccidae—IV (Hemiptera). Canadian Entomologist, 51(11):249-253; figs. 33-36. Published November 20.
27. Why not government-maintained fellowships? Science, (N. S.) 50 (1302):543-544. Published December 12.
28. A new species of Pseudodiaspis (Hemiptera; Coccidae).

Entomological News, 30(10):275-276; 1 fig. Published December 20.

1920

29. Contributions toward a monograph of the sucking lice. Part I. Leland Stanford Junior University Publications, University Series, Biological Sciences, 2(1):1-52 [p. 52 is blank]; figs. 1-32. Dated 1919, but actually published January 14, 1920.
30. Clarke nutcracker at sea. Condor, 22(1):39. Published January 26.
31. Notes on Coccidae—V (Hemiptera). Canadian Entomologist, 52(2):29-32; figs. 7-11. Published February 28.
32. The first stage larva of *Cuterebra americana* (Fabr.) (Diptera; Oestridae). Psyche, 27(1):13-14; fig. 1. February number.
33. Notes on Coccidae—VI (Hemiptera). Canadian Entomologist, 52(3):61-65; fig. 12. Published March 31.
34. Some records of Polyctenidae (Hemiptera). Journal of the New York Entomological Society, 27(4):261-263; pl. XXIV. Published April 17.
35. Scale insects of the Santa Cruz Peninsula. Stanford University Publications, University Series, Biological Sciences, 1(1):1-57; figs. 1-35. (Received at the California Academy of Sciences Library on July 30.)
36. Insects of economic importance in the Cape Region of Lower California, Mexico. Journal of Economic Entomology, 13(6):463-467. December number.

1921

37. Notes on Coccidae—VII (Hemiptera). Canadian Entomologist, 53(3):57-61. Published April 4.
38. Review of "Monografia delle Cocciniglie Italiane." Entomological News, 32(5):157. Published May 3.
39. Notes on Coccidae—VIII (Hemiptera). Canadian Entomologist, 53(4):91-95. Published June 8.
40. Some Coccidae from eastern Asia. Bulletin of Entomological Research, 12(3):211-220; figs. 1-7. November number, published in September.
41. The Coccidae of Ceylon [*in re funds for publication*].

- Science, (N.S.) 54 (1397):330. Published October 7.
42. Contributions toward a monograph of the sucking lice. Part II. Stanford University Publications, University Series, Biological Sciences, 2(2):53-134 [pp. 58 and 134 are blank]; figs. 33-89. Published October 14.
43. Report upon a collection of Coccidae from Lower California. Stanford University Publications, University Series, Biological Sciences, 1(2):59-132; figs. 1-52. (Received at the California Academy of Sciences Library on November 18.)
44. A new species in the Hormaphidinae (Hemiptera, Aphididae). Entomological News, 32(10):289-291; pl. VI. Published December 16.

1922

45. Concerning lice. Journal of Mammalogy, 3(1):16-18. Published February 8.
46. The mallophagan family Trimenoponidae. Parasitology, 14(1):75-86; figs. 1-8. Published April 25.
47. (Senior author with F. R. Cole) A contribution to the knowledge of the Hippoboscidae (Diptera, Pupipara). Parasitology, 14(2):178-205; figs. 1-20. Published June 15.
48. Review of "The Coccidae of Ceylon," by E. E. Green. Science, (N.S.) 56 (1446):312-313. Published September 15.
49. Notes on Coccidae—IX (Hemiptera). Canadian Entomologist, 54(7):156-161; figs. 1-4. Published October 12.
50. Contributions toward a monograph of the sucking lice. Part III. Stanford University Publications, University Series, Biological Sciences, 2(3):135-138 [p. 138 is blank]; figs. 90-118. (Received at the California Academy of Sciences Library on October 19.)
51. A note on *Timema californicum* Scudder (Orthoptera; Phasmidae). Entomological News, 33(9):282-283. Published November 3.
52. De anopluris. Scientific Monthly, 15(6):551-556.
53. Two new Coccidae from Cyrenaica. Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici, 16:207-210; figs. 1-2. This parti-

cular article was published on December 15.

54. Notes on Coccidae—X (Hemiptera). Canadian Entomologist, 55(11):246–248. Published December 30.

1923

55. Observations on the larvae of some Diptera Pupipara, with description of a new species of Hippoboscidae. Parasitology, 15(1):54–58; figs. 1–4. Published March 22.
56. (Senior author with Persis Hyatt) The life history of *Euphyllura arbuti* Schwarz (Hemiptera; Chermidae). Canadian Entomologist, 55(4):88–92; pl. 2. Published May 10.
57. The place of the systematist in modern biology. Scientific Monthly, 16(5):514–520. May number.
58. Mallophaga. In: Biological Survey of the Pribilof Islands, Alaska. North American Fauna, No. 46, Part II, p. 141. Published June 20.
59. (Senior author with J. B. Kelly) Some Coccidae from about the Gulf of California. Proceedings of the California Academy of Sciences (Fourth Series), 12(14):315–318; 1 fig. Published July 10.
60. Mallophaga. In: Report of the Scientific Results of the Norwegian Expedition to Novaya Zemlya 1921. 1(8):11–12. Published in July.
61. Entomological illustrations. Science, (N.S.) 58(1501):265–266. Published October 5.
62. Observations on the Chermidae (Hemiptera; Homoptera). Part I. Canadian Entomologist, 55(11):250–256; pl. 12, and text fig. 1. Published November 29.
63. Contributions toward a monograph of the sucking lice. Part IV. Stanford University Publications, University Series, Biological Sciences, 2(4):179–270; figs. 119–172. (Received at the California Academy of Sciences Library on January 4, 1924.)

1924

64. Two Diptera Pupipara from Philippine bats. Philippine Journal of Science, 24(1):73–79; figs. 1–3. Published January 22.
65. The mallophagan family Menoponidae. Part I. Parasitology, 16(1):55–66; figs. 1–5. Published January 31.

66. [General comments on the immature stages of the Psyllidae.] As quoted in the Minutes of the 87th meeting, Proceedings of the Pacific Coast Entomological Society, 2(2):24. Published January 31.
67. The study of minute insects. Canadian Entomologist, 56(2):25-28. Published February 29.
68. Report upon a collection of insect ectoparasites from Australian and Tasmanian mammals. (Diptera Pupipara. Siphonaptera). American Museum Novitates. No. 110:1-7; figs. 1-5. Published April 21.
69. The New World Nycteribiidae (Diptera Pupipara). Entomological News, 35(6):191-199; pl. 3, and 1 text fig. Published June 4.
70. The nymphs of two species of Chermidae (Hemiptera). Pan-Pacific Entomologist, 1(1):24-28; figs. 1-2. Published June 25.
71. A note on some Hippoboscidae (Diptera Pupipara). Entomological News, 35(7):234-235. Published July 3.
72. Some Diptera Pupipara from the Philippine Islands. Philippine Journal of Science, 25(4):391-403 [p. 402 is blank]; figs. 1-7. Published November 17.

1925

73. Observations on the Chermidae (Hemiptera; Homoptera). Part II. Canadian Entomologist, 57(2):46-50; figs. 1-3. Published February 28.
74. On two species of the genus Halarachne (Acarina; Gamasidae). Parasitology, 17(2):163-167; figs. 1-2. Published May 18.
75. The content of systematic biology. Scientific Monthly, 20(6):653-658. June number.
76. Third report upon Diptera Pupipara from the Philippine Islands. Philippine Journal of Science, 27(3):413-421; figs. 1-5. Published August 3.
77. Notes on Coccidae—XI (Hemiptera). Canadian Entomologist, 57(9):228-234; figs. 1-4. Published September 26.
78. (with L. E. Myers) The generic types of the Diaspididae (Hemiptera). Bulletin of Entomological Research, 16(2):163-167; pls. 12-13. Published in October.
79. Fourth report upon Diptera Pupipara from the Philippine

Islands. Philippine Journal of Science, 28(3):329-341 [p. 340 is blank]; figs. 1-5. Published November 6.

80. Systematic problems and work [a short general statement apparently quoted in full, in the Minutes of the 97th meeting]. Proceedings of the Pacific Coast Entomological Society, 2(4):59-60. Published after mid-June, 1925 (see notes following this numbered bibliography).

1926

81. The mallophagan family Menoponidae. Part II. Parasitology, 18(1):1-3; 1 fig. Published January 22.
82. Observations on the Chermidae (Hemiptera: Homoptera). Part III. Canadian Entomologist, 58(1):13-20; figs. 1-5. Published January 30.
83. Indians' Hair [congregations of Phalangida on tree trunks in Mexico.] Nature Magazine, 8(4):222; 1 fig. October number.
84. Report upon a collection of Hippoboscidae (Diptera Pupipara) from Borneo. Sarawak Museum Journal, 3 (Part III, No. 10):279-286; pl. 11 and text figs. 1-2. December number.

1927

85. (Senior author with E. W. Nissen) The larva of a species of the Cassididae (Coleoptera). Pan-Pacific Entomologist, 3(4):169-172; 1 fig. Published June 9.
86. The generic types of the Diaspididae (Hemiptera). (Introductory note to Part II). Bulletin of Entomological Research, 17(4):341. Published in June.
87. Hippoboscidae. British Museum (Natural History): Insects of Samoa, and other Samoan terrestrial Arthropoda. Part VI, Diptera; fascicle 1, pp. 10-21; figs. 1-6. Published July 23.
88. Mealybugs. Monthly Bulletin of the Department of Agriculture, State of California, 16(6):336-342. June number (received at the California Academy of Sciences Library on August 10.)
89. Some American Hippoboscidae (Diptera Pupipara). Canadian Entomologist, 59(10):246-251; figs. 1-4. Published in October.

90. Fifth report upon Diptera Pupipara from the Philippine Islands. Philippine Journal of Science, 34(2):207-233; figs. 1-19. Published November 9.
91. Notes on an entomological enigma. Canadian Entomologist, 59(12):279-281; 1 fig. Published December 11.

1928

92. The larva of *Olfersia vulturis* Van der Wulp. (Diptera: Hippoboscidae). Entomological News, 39(2):36-37; 1 fig. Published February 3.
93. The genus *Myialges* (Acarina: Sarcoptidae). Entomological News, 39(5):137-140; pl. III. Published May 3.
94. Observations on the Chermidae (Hemiptera: Homoptera). Part IV. Canadian Entomologist, 60(5):109-117; figs. 1-4. Published June 2.
95. The genus *Brachypteromyia* Williston (Diptera Pupipara; Hippoboscidae). Pan-Pacific Entomologist, 4(3):140-142; figs. 1-2. Published June 26.
96. (Senior author with J. C. Chamberlin) On the use of the word "Chitinized." Entomological News, 39(7):212-215. Published July 2.
97. The mallophagan family Menoponidae. Part III. Parasitology, 20(2):221-227; figs. 7-9. (Not seen by compiler.)
98. Observations on the Chermidae (Hemiptera: Homoptera). Part V. Canadian Entomologist, 60(10):240-245; figs. 1-3. Published October 29.
99. The principles of systematic entomology. Stanford University Publications, University Series, Biological Sciences, 5(3):101-270 [also separately paged 1-170; pp. 106, 108 and 270, or 6, 8 and 170 are blank], figs. 1-11. Published in December.
100. Review of "A Classification of the higher groups and genera of the coccid family Margarodidae," by H. Morrison. Entomological News, 39(10):325-327. Published December 17.
101. The wax-secreting organs of the Coccidae. Pan-Pacific Entomologist, 5(2):67-70. Published December 29.
102. Scientific exploration, a phantasy. Scientific Monthly, 27:537-541. December number.

1929

103. (Junior author with J. C. Chamberlin) On *Liparocephalus* and allied genera (Coleoptera; Staphylinidae). *Pan-Pacific Entomologist*, 5(3):137-143. Published April 18.
104. (Junior author with J. C. Chamberlin) On *Liparocephalus* and allied genera (Coleoptera; Staphylinidae). *Pan-Pacific Entomologist*, 5(4):153-162; figs. 1-5. (Continuation of previous item.) Published May 31.
105. Systematic biology and the mutation theory. *Quarterly Review of Biology*, 4(3):389-400. Published in September.
106. Concerning the Mediterranean fruit fly. *Science*, (N.S.) 70(1819):451-453. Published November 8.
107. Review of "A Manual of External Parasites," by H. E. Ewing. *Entomological News*, 40(10):337-341. Published December 19.

1930

108. Observations on the genus *Ornithoica* (Diptera: Hippoboscidae). *Canadian Entomologist*, 61(12):280-285; figs. 1-4. The December, 1929 number, but actually published on January 4, 1930.
109. The effectiveness of a plant quarantine. *Science*, (N.S.) 71(1829):68-69. Published January 17.
110. Some New World Hippoboscidae (Diptera Pupipara). *Canadian Entomologist*, 62(3):62-70; figs. 1-5. Published March 31.
111. The plant quarantines once more. *Science*, (N.S.) 71(1850):606-607. Published June 13.
112. Some African Diptera Pupipara. *Parasitology*, 22(3):275-282; figs. 1-6. Published July 30.
113. The puparium of *Basilis corynorhini* (Ferris) (Diptera: Nycteribiidae). *Entomological News*, 41(9):295-297, 1 fig. Published November 7.
114. Report upon certain ectoparasites of mammals. *In*: Report of the Harvard-African Expedition upon the African Republic of Liberia and the Belgian Congo, 2:1022-1038; figs. 12-24. (Not seen by compiler.)
115. Plant quarantines run wild. *New Republic*, 63:335-338. (Not seen by compiler.)
116. Sixth report upon Diptera Pupipara from the Philippine

Islands. Philippine Journal of Science, 43(4):537-553; figs. 1-7. Published November 10.

1931

117. The louse of elephants. *Haematomyzus elephantis* Piaget (Mallophaga; Haematomyzidae). Parasitology, 23(1):112-127; text figs. 1-5, pls. 4-5. Published January 31.

1932

118. Contributions toward a monograph of the sucking lice. Part V. Stanford University Publications, University Series, Biological Sciences, 2(5):271-414 [p. 414 is blank; this item is also separately paged 1-143]; figs. 173-251. Published October 15.
119. New species and other records of Mallophaga from the Marquesas. B. P. Bishop Museum, Bulletin No. 98, pp. 53-72; figs. 8-20. (Marquesan Insects—I. Pacific Entomological Survey Publication I, article 5.)
120. Ectoparasites of Marquesan rats. B. P. Bishop Museum, Bulletin No. 98, pp. 117-127; figs. 35-39. (Pacific Entomological Survey Publication I, article 12.)
121. (With F. D. Klyver) Report upon a collection of Chermidae (Homoptera) from New Zealand. Transactions and Proceedings of the New Zealand Institute, 63(1):34-61; pls. 7-16. Published October 30.
122. Mallophaga from Tahiti. B. P. Bishop Museum, Bulletin No. 113, pp. 7-12; figs. 1-4. (Society Island Insects. Pacific Entomological Survey Publication 6, article 2.) Published December 23.

1933

123. A new species of *Polyplax* (Anoplura). Parasitology, 25(1):127-129; figs. 1-2. Published March 4.
124. The mallophagan genus *Trichophilopterus*. Parasitology, 25(4):468-471; figs. 1-2. Published December 7.
125. Contribution toward a monograph of the sucking lice. Part VI. Stanford University Publications, University Series, Biological Sciences, 2(6):415-470 [p. 418 is blank; this item is also separately paged 1-56]; figs. 253-276. Published December 15.

1934

126. Review of "The efficacy and economic effects of plant quarantines in California." *Science*, (N.S.) 79(2036):13-14. Published January 5.
127. A summary of the sucking lice. (Anoplura.) *Entomological News*, 45(3):70-74. Published March 9.
128. A summary of the sucking lice (Anoplura). *Entomological News*, 45(4):85-88. (Continuation of previous item.) Published April 10.
129. Contributions toward a monograph of the sucking lice. Part VII. Stanford University Publications, University Series, Biological Sciences, 2(7):471-526 [p. 474 is blank; this item is also separately paged 1-56]; figs. 277-305. Published June 1.
130. Setae. *Canadian Entomologist*, 66(7):145-150; 2 figs. Published August 31.

1935

131. The prothoracic pleurites of Coleoptera. *Entomological News*, 46(3):63-68; fig. 1. Published March 7.
132. The prothoracic pleurites of Coleoptera. *Entomological News*, 46(4):93-95. (Continuation of previous item.) Published April 3.
133. Scale insects (Hemiptera: Coccoidea) from the Marquesas. B. P. Bishop Museum, Bulletin No. 142, pp. 125-131, figs. 1-3. (Marquesas Insects—III. Pacific Entomological Survey, Publication 8, article 9.) Published May 29.
134. An apparently undescribed mealybug (Hemiptera: Pseudococcidae) from Tahiti. B. P. Bishop Museum, Bulletin No. 142, pp. 133-135; fig. 1. (Marquesas Insects—III. Pacific Entomological Survey Publication 8, article 10.) Published May 29.
135. Contributions toward a monograph of the sucking lice. Part VIII. Stanford University Publications, University Series, Biological Sciences, 2(8):527-634 [also separately paged 1-108]; text figs. 306-338, pls. I-III, plus an Erratum slip relating to pls. I and II. Published July 2.

1936

136. Foreword [to the first issue of the new journal *Micro-*

- entomology]. *Microentomology*, 1(1):1. Published January 27.
137. Contributions to the knowledge of the Coccoidea (Homoptera). *Microentomology*, 1(1):2-16; figs. 1-10. Published January 27.
138. (Senior author with Michael Doudoroff) Taxonomic problems in Lepidoptera. *Entomological News*, 47(5):124-128. Published May 8.
139. Review of "Bibliography of Australian Entomology 1775-1930 with bibliographical notes on authors and collectors" by A. Musgrave. *Pan-Pacific Entomologist*, 12(2):64. Published May 15.
140. Contributions to the knowledge of the Coccoidea (Homoptera). II. *Microentomology*, 1(2):17-92; figs. 11-74. Published May 22.
141. (Senior author with G. E. Murdock) Contributions to the knowledge of the Coccoidea (Homoptera). III. *Microentomology*, 1(4):115-122; figs. 83-85. Published December 9.

1937

142. Atlas of the scale insects of North America. Series 1, Numbers 1-136. Stanford University Press. (No page numbers, each Number to be considered as a separate publication.) Published in January.
143. Contributions to the knowledge of the Coccoidea (Homoptera). IV. *Microentomology*, 2(1):1-45; figs. 1-36. Published March 24.
144. On certain words used in connection with the Coccoidea (Homoptera). *Entomological News*, 48(5):141-143. Published May 13.
145. Contributions to the knowledge of the Coccoidea (Homoptera). V. *Microentomology*, 2(2):47-102; figs. 37-79. Published June 15.
146. Contributions to the knowledge of the Coccoidea (Homoptera). VI. *Microentomology*, 2(3):103-122; figs. 80-95. Published November 24.
147. On nomenclatorial and other problems in the systematics of the Coccoidea (Insecta: Homoptera). *Annals and Maga-*

zine of Natural History, (Tenth Series) 20(119):525-530. November number.

1938

148. Contributions to the knowledge of the Coccoidea (Homoptera). VII. Microentomology, 3(2):37-56; figs. 17-32. Published April 28.
149. Atlas of the scale insects of North America. Series 2, Numbers 137-268. Stanford University Press. (No page numbers, each Number to be considered as a separate publication.) Published in November.
150. Contributions to the knowledge of the Coccoidea (Homoptera). VIII. Microentomology, 3(3):57-75; figs. 32-44. Published December 10.
151. In forests of hair and feathers. Where insects live in virtual darkness and are adapted to their environment. Nature Magazine, 31(10):591-592, 1 fig. December number.

1939

152. Review of "The Genus *Septobasidium*. By John N. Couch." Entomological News, 49(10):297-298. Number for December, 1938, but not actually published until January 11, 1939.
153. (Senior author with R. L. Usinger) The family Polycetenidae (Hemiptera; Heteroptera). Microentomology, 4(1):1-50; figs. 1-25. Published February 21.
154. (Senior author with B. E. Rees) The morphology of *Panorpa nuptialis* Gerstaecker (Mecoptera: Panorpidae). Microentomology, 4(3):79-108; figs. 36-51. Published October 17.
155. (Senior author with P. Pennebaker) The morphology of *Agulla adnixa* (Hagen) (Neuroptera: Raphididae). Microentomology, 4(5):121-142; figs. 59-72. Published November 22.
156. (Junior author with B. E. Rees [and C. P. Alexander, see following]) The morphology of *Tipula reesi* Alexander (Diptera: Tipulidae). Microentomology, 4(6):143, 145-178 [the last part of p. 143 and all of p. 144 are by C. P. Alexander]; figs. 72-91. Published December 20.

1940

157. The morphology of *Plega signata* (Hagen) (Neuroptera:

Mantispidae). *Microentomology*, 5(2):33-56; figs. 6-20. Published May 15.

158. The myth of the thoracic sternites of insects. *Microentomology*, 5(3):87-90. Published June 4.

1941

159. Atlas of the scale insects of North America. Series 3, Numbers 269-384. Stanford University Press. (No page numbers, each Number to be considered as a separate publication.) Published March 27.
160. Contributions to the knowledge of the Coccoidea (Homoptera). IX. A forgotten genus of the family Margarodidae. *Microentomology*, 6(1):6-10; fig. 3. Published March 28.
161. Contributions to the knowledge of the Coccoidea (Homoptera). X. Illustration of eleven genotypes of the Diaspididae. *Microentomology*, 6(1):11-24; figs. 4-14. Published March 28.
162. Contributions to the knowledge of the Coccoidea (Homoptera). XI. A new genus in the Pseudococcidae (Homoptera; Coccoidea). *Microentomology*, 6(1):25-28; figs. 15-16. Published March 28.
163. A new species of *Stomacoccus* (Homoptera; Coccoidea; Margarodidae). *Microentomology*, 6(1):29-32; figs. 17-18. Published March 28.
164. The genus *Aspidiotus* (Homoptera; Coccoidea; Diaspididae). *Microentomology*, 6(2):33-70; figs. 19-26. Published November 28.

1942

165. (Senior author with E. G. Linsley and R. L. Usinger) An American Entomological Code. (In the Minutes of the 169th meeting, Proceedings of the Pacific Coast Entomological Society) *in*: *Pan-Pacific Entomologist*, 18(1):44-45. Published February 19.
166. Insect morphology and evolution. Abstract of an address for the Entomological Society of America. Proceedings of the Thirty-Sixth Annual Meeting, *in*: *Annals of the Entomological Society of America*, 35(1):114-116. Published April 2.
167. Atlas of the scale insects of North America. Series 4,

- Number 385-448. Stanford University Press. (No page numbers, each Number to be considered as a separate publication.) Published May 28.
168. The needs of systematic entomology. *Journal of Economic Entomology*, 35(5):732-738. October number.
169. Observations on some ectoparasitic mites (Arachnida: Acarina: Dermanyssidae). *Microentomology*, 7(3):77-83; figs. 36-38. Published December 28.
170. Some North American, rodent-infesting lice (Insecta: Anoplura). *Microentomology*, 7(3):84-90; figs. 39-42. Published December 28.

1943

171. Some fundamental concepts in insect morphology. *Microentomology*, 8(1):2-7. Published May 6.
172. The basic materials of the insect cranium. *Microentomology*, 8(1):8-24; figs. 1-6. Published May 6.
173. Additions to the knowledge of the Diaspididae (Homoptera: Coccoidea). *Microentomology*, 8(2):58-79; figs. 24-32. Published September 22.
174. The genus *Targionia* Signoret and some of its allies (Homoptera: Coccoidea: Diaspididae). *Microentomology*, 8(3):81-111; figs. 33-43. Published December 30.

1944

175. On certain evolutionary tendencies in the heads of insects. *Microentomology*, 9(2):78-84; fig. 40. Published December 20.

1945

176. (Senior author with R. L. Usinger) Notes and descriptions of American Polycetenidae (Hemiptera). *Pan-Pacific Entomologist*, 21(4):121-124. Published November 26.

1946

177. Information concerning the genera *Chortinaspis* and *Aspidiotus* (Homoptera: Coccoidea: Diaspididae). *Microentomology*, 11(1):37-49; figs. 16-20. Published April 30.

1947

178. (Senior author with V. P. Rao) The genus *Pinnaspis*

Cockerell (Homoptera: Coccoidea: Diaspididae). Microentomology, 12(2):25-58; figs. 10-12. Published October 22.

179. The contradictions of the insect head. Microentomology, 12(3):59-64. Published November 10.

1948

180. The principles of comparative morphology. Microentomology, 13(3):49-56. Published September 15.

1949

181. (Senior author with L. M. Henry) The nervous system and a problem of homology in certain Crustacea (Crustacea: Copepoda: Caligidae). Microentomology, 14(4):113-118; figs. 66-67. Published December 20.

1950

182. Report upon scale insects collected in China (Homoptera: Coccoidea). Part I. Microentomology, 15(1):1-34; figs. 1-20. Published February 21.
183. Report upon scale insects collected in China (Homoptera: Coccoidea). Part II. Microentomology, 15(3):69-97; figs. 30-47. Published July 27.
184. A reply to criticism. Microentomology, 15(4):126-128. Published October 20.
185. Atlas of the scale insects of North America. Series 5, The Pseudococcidae. Part I. Stanford University Press, vii + 278 pp.; figs. 1-108. (Not seen by compiler.)
186. External morphology of the adult. Chapter 5, pp. 368-419 in: Demerec's "Biology of Drosophila." John Wiley and Sons, Inc., New York. (Not seen by compiler.)

1951

187. The sucking lice. Memoirs of the Pacific Coast Entomological Society, San Francisco. Memoir 1: x + 320 pp.; figs. 1-124. Published October 19.

1952

188. Some miscellaneous Coccoidea (Insecta: Homoptera). Microentomology, 17(1):2-5; figs. 1-2. Published February 8.

189. Report upon scale insects collected in China (Homoptera: Coccoidea). III. Microentomology, 17(1):6-16; figs. 3-9. Published February 8.
190. (Junior author with V. P. Rao) The genus *Andaspis* MacGillivray (Insecta: Homoptera: Coccoidea). Microentomology, 17(1):17-32; figs. 10-19. Published February 8.

1953

191. On the comparative morphology of the Annulata. A summing up. Microentomology, 18(1):2-15. Published January 1.
192. (Senior author with R. L. Usinger) A new species of *Aphraniola* from Cambodia [Hemiptera, Cimicidae]. Revue française d'Entomologie, 20(2):138-139. Published July 25.
193. Illustrations of three species of sucking lice, with notes on a fourth species (Insecta: Anoplura). Microentomology, 18(2):52-57; figs. 19-22. Published August 31.
194. Report upon scale insects collected in China (Homoptera: Coccoidea). Part IV. Microentomology, 18(3):59-84; figs. 23-39. Published September 22.
195. Atlas of the scale insects of North America. The Pseudococcidae. Part II. Volume VI. Stanford University Press, vii + pp. 279-506; figs. 109-193. (Not seen by compiler.)

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196. A new species of Anoplura. Annals of the Natal Museum, 13(1):91-94; 1 text fig. Published June 30.
197. New species of Diaspididae from Florida and the Caribbean Islands (Homoptera: Coccoidea). Microentomology, 19(2):41-50; figs. 26-31. Published July 15.
198. Report upon scale insects collected in China (Homoptera: Coccoidea). Part V. Microentomology, 19(2):51-66; figs. 32-42. Published July 15.

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199. Atlas of the scale insects of North America. Volume VII. Stanford University Press, iii + 233 pp.; 94 figs. (Exact date not known to compiler.)
200. On some genera of the Pseudococcidae (Homoptera: Coccoidea). Microentomology, 20(1):1-19; figs. 1-13. Published January 28.

201. Some miscellaneous Coccoidea (Insecta: Homoptera). Microentomology, 20(2):21-29; figs. 14-17. Published April 15.
202. Report upon a collection of scale insects from China. VI. (Insecta: Homoptera). Microentomology, 20(2):30-40; figs. 18-24. Published April 15.
203. The genus *Phenacaspis* Cooley and Cockerell. Part I. (Insecta: Homoptera: Coccoidea). Microentomology, 20(3):41-82; figs. 25-52. Published August 1.
204. The contribution of natural history to human progress. Pp. 75-87 in: *A Century of Progress in the Natural Sciences, 1853-1953*. Published in Celebration of the Centennial of The California Academy of Sciences. California Academy of Sciences, San Francisco. Published October 20.
205. Some minute insects: Anoplura. Mallophaga and the scale insects. Pp. 517-523 in: *A Century of Progress in the Natural Sciences, 1853-1953*. Published in Celebration of the Centennial of The California Academy of Sciences. California Academy of Sciences, San Francisco. Published October 20.

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206. The genus *Phenacaspis* Cooley and Cockerell. Part II. (Insecta: Homoptera: Coccoidea). Microentomology, 21(2):67-83; figs. 35-43. Published April 13.

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207. (Senior author with R. L. Usinger) Notes on and descriptions of Cimicidae (Hemiptera). Part I. Microentomology, 22(1):1-37; figs. 1-25. Published April 15.
208. Two species of Diaspididae new to the Hawaiian fauna (Homoptera: Coccoidea). Proceedings of the Hawaiian Entomological Society, 16(2):212-215; figs. 1-2. Published May 13.
209. (Senior author with R. L. Usinger) Hemiptera: Heteroptera: Cimicidae. South African Animal Life, 4:374-376; 1 fig. (Exact publication date not known to compiler.)
210. A brief history of the study of the Coccoidea. Microentomology, 22(2):39-57; fig. 26. Published July 1.
211. Notes on some little known genera of the Coccoidea (Homop-

tera). *Microentomology*, 22(3):59-79; figs. 27-38. Published September 4.

212. A review of the family Eriococcidae (Insecta: Coccoidea). *Microentomology*, 22(4):81-89; figs. 39-43. Published October 15.

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213. The nervous system of insects. Proceedings of the Tenth International Congress of Entomology, Montreal, August 17-25, 1956. 1:469-472. Published in December.
214. The geographic distribution of the Coccoidea. [A short abstract only.] Proceedings of the Tenth International Congress of Entomology, Montreal, August 17-25, 1956. 1:829. Published in December.

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215. (Senior author with R. L. Usinger) A new species of *Stricticimex* from Kenya (Hemiptera: Cimicidae). *Annals of the Entomological Society of America*, 52(1):81-82; figs. 1-2. Published in February.
216. (With R. L. Usinger) Heteroptera: Cimicidae. *In: Insects of Micronesia*. B. P. Bishop Museum. [In press.]
217. Sections Insecta, Mallophaga and Anoplura. *In: Encyclopedia of Science and Technology*. McGraw-Hill Book Co., Inc. [In press.]

UNTITLED NOTES PRESENTED IN THE PROCEEDINGS OF THE
PACIFIC COAST ENTOMOLOGICAL SOCIETY

A. Appearing in the two separately published volumes of
The Proceedings of the Pacific Coast Entomological
Society and as reported in the Minutes of the meetings.

1919. [Reference to fleas on mountain beaver, and a polychaete on bats] Proceedings of the Pacific Coast Entomological Society, 1: unnumbered page carrying the Minutes of the 71st meeting.
1920. [Comment on the scarcity of Lepidoptera and Odonata in Lower California during the summer of 1919.] *Loc. cit.*, 1: unnumbered page carrying the first part of the Minutes of the 74th meeting.
1922. [Very general note on the sucking lice.] Minutes of the

- 83rd meeting. *Loc. cit.*, 2(1):7. Published November 15.
- 1927? [Note on some California scale insects.] Minutes of the 106th meeting. *Loc. cit.*, 2(6):93. Published between late June, 1927 and the beginning of March, 1928.
- 1927? [Report on Mr. Meyers' studies on the parasitism of swallows by a species of *Cimex*.] Minutes of the 107th meeting. *Loc. cit.*, 2(7):97. Published between late June, 1927 and the beginning of March, 1928.
- 1928? [On the nymphs of the Psyllidae, and on the then-unidentified larva of the beetle *Brachypsectra*; see also *loc. cit.* p. 105.] Minutes of the 112th meeting. *Loc. cit.*, 2(7):109. Published between the beginning of May, 1928, and early February, 1929.
- 1929? [On the staphylinid beetle genus *Liparocephalus*.] Minutes of the 116th meeting. *Loc. cit.*, 2(8):121-122. Published between late April, 1929, and late January, 1930.
- 1929? [On the larva of *Brachypsectra*.] Minutes of the 116th meeting. *Loc. cit.*, 2(8):122. Published between late April, 1929, and late January, 1930.
- B. Appearing in The Proceedings of the Pacific Coast Entomological Society, as published in The Pan-Pacific Entomologist, and as reported in the Minutes of the meetings.
1936. [General comments on the sucking lice.] Minutes of the 129th meeting. Proceedings of the Pacific Coast Entomological Society, *in*: The Pan-Pacific Entomologist, 11(4):186. This, the October, 1935 issue of the journal was published on January 10, 1936.
1938. [Announcing the preparation of an atlas of scale insects.] Minutes of the 145th meeting. *Loc. cit.*, 14(4):192. Published November 15, 1938.
1939. [Comment on the stability of species, with a definition.] Minutes of the 147th meeting. *Loc. cit.*, 15(1):46. Published February 10, 1939.
1940. [General remarks on a trip to Panama.] Minutes of the 153rd meeting. *Loc. cit.*, 16(1):39. Published February 17, 1940.
1940. [On the principles of geographic distribution.] Minutes of the 155th meeting. *Loc. cit.*, 16(1):42.

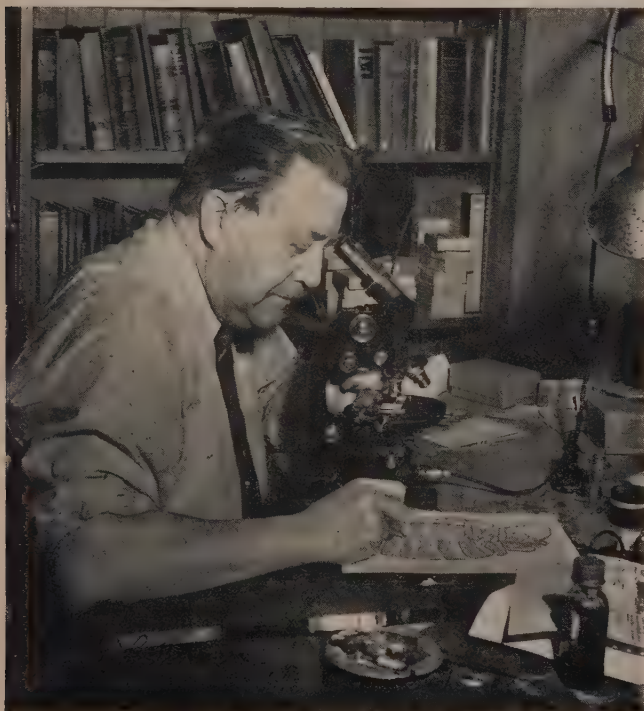
1940. [General note.] Minutes of the 158th meeting. *Loc. cit.*, 16(1):45.
1941. [General remarks.] Minutes of the 162nd meeting. *Loc. cit.*, 17(1):42. Published February 21, 1941.
1942. [Comment on ectoparasites.] Minutes of the 166th meeting. *Loc. cit.*, 18(1):40-41. Published February 19, 1942.
1943. [Movement for an American Commission on Scientific Nomenclature in Entomology.] Minutes of the 173rd meeting. *Loc. cit.*, 19(1):37. Published March 22, 1943.
1943. [More on the American Commission (see preceding item); comment on his Atlas of Scale Insects.] Minutes of the 175th meeting. *Loc. cit.*, 19(1):38, 39.
1946. [General comments on the mealybugs of North America.] Minutes of the 187th meeting. *Loc. cit.*, 22(1):36-37. Published March 29, 1946.
1946. [Labor-saving devices in entomological drawing.] Minutes of the 188th meeting. *Loc. cit.*, 22(1):39.
1948. [Resumé of an address on "The Mealybugs of North America."] Minutes of the 193rd meeting. *Loc. cit.*, 24(1):39-40. Published March 31, 1948.
1949. [A comment on Dr. Henry's work on the nervous system of the lower invertebrates, as relating to the hypopharynx of insects.] Minutes of the 199th meeting. *Loc. cit.*, 25(1):42. Published March 17, 1949.
1953. [Comment on the principles of comparative morphology of arthropods.] Minutes of the 223rd meeting. *Loc. cit.*, 29(1):64. Published March 23, 1953.
1957. [Resumé of a talk on the family Margarodidae.] Minutes of the 247th meeting. *Loc. cit.*, 33(1):47. Published March 22, 1957.
1957. [Comment on the 10th International Congress of Entomology.] Minutes of the 250th meeting. *Loc. cit.*, 33(1):49.
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PACIFIC COAST ENTOMOLOGICAL SOCIETY

R. L. DOUTT
Vice-President

D. D. JENSEN
President

D. P. FURMAN
Secretary



GORDON FLOYD FERRIS (1893 - 1958)

PROCEEDINGS

Two Hundred and Fifty-seventh Meeting

The two hundred and fifty-seventh meeting of the Pacific Coast Entomological Society was held February 14, 1958, at 7:40 p.m. in the Morrison Auditorium, California Academy of Sciences, San Francisco, California. President D. D. Jensen presided at the meeting.

The following members were present: A. E. Michelbacher, E. O. Essig, P. H. Arnaud, Jr., G. F. Ferris, L. M. Henry, R. L. Doutt, K. P. Shea, D. H. Groves, S. W. Hitchcock, M. S. Wasbauer, J. A. Powell, E. L. Kessel, F. E. Skinner, B. Barichievich, D. Breedlove, M. Kenny, J. G. Edwards, C. J. Worthington, A. Ross, P. F. Torchio, D. J. Burdick, P. D. Ashlock, D. D.

Linsdale, L. A. Ruud, T. S. Acker, D. M. Maddox, W. E. Ferguson, Jane MacSwain, J. W. MacSwain, E. G. Linsley, W. W. Middlekauff, R. L. Langston, W. A. Russell, D. G. Denning, K. S. Hagen, D. D. Jensen, D. P. Furman, H. B. Leech. Visitors were Martha Michelbacher, Marie Essig, F. D. Bennett, S. M. Sager, Frances Powell, Carl Kaufeldt, Phil Capitate, William Tuft, Beverly Ehreth, Bertha B. Kessel, Terry Seeno, Dolores Damiano, Virginia Ashlock, Barry E. Pullen, Walter E. Rathgen, Nancy MacSwain, John MacSwain, Juanita Linsley, Katherine Furman, Phillis Middlekauff, Evelyn Langston, Elsa P. Russell, Loretta Denning.

The minutes of the meeting held December 7, 1957 were read and approved.

The President announced appointment of the following members to serve as a committee to judge the merits of the entomological exhibits at the annual science fair: Kenneth Hagen, Chairman; Laura Henry, Otto Graph.

Dr. Hagen commented briefly on the nature and mechanics of the award. The first place award consists of an entomological book and a one year honorary membership in the Society. The Society will send letters of commendation to the recipients of the first three places in the judging. The exhibits need not be of the systematic collection type to compete for an award.

The President announced the following changes in membership of standing committees:

Historical—E. O. Essig, Chairman, E. S. Ross, R. L. Usinger, J. W. Tilden, H. B. Leech.

Editorial Board—P. D. Hurd, Jr., Editor; J. A. Powell, H. B. Leech, E. G. Linsley, E. S. Ross, R. L. Usinger, J. E. Swift, R. C. Miller.

Membership—Herbert Ruckes, Jr., Chairman; J. Gordon Edwards, Howard L. McKenzie.

The President discussed briefly types of membership open in the Society with particular emphasis on the student membership category which enables students to enjoy membership at a reduced cost.

Dr. Edwards nominated the following for regular membership: Mr. Johnson C. Montgomery, Dr. Leland R. Brown, Miss Dolores Damiano, Mr. Keith Radford. They were elected by unanimous vote.

The President announced the reinstatement of C. Don MacNeill as a regular member of the Society.

Dr. K. S. Hagen exhibited equipment devised for airplane collections of *Hippodamia convergens* Guérin. The device is to be used in checking the hypothesis that migration flights of the beetles from their concentration sites in transition zone areas are made in the upper air where easterly winds blow them westward. Previously it was believed that dispersion flights followed down canyons and into the valley. Earlier attempts to follow flights of marked beetles have been unsuccessful. The present airplane trap, which looks superficially like a wing tip fuel tank, has ten discs which may be dropped individually to an exposed position at will. A screen on the disc is supplied with an adhesive substance containing rosin and castor oil; any beetles contacting the disc are expected to adhere to it.

Mr. H. B. Leech discussed the current status of historical files of the Society. Authorization has been granted to obtain another filing cabinet to relieve the congestion in the single file now available for such material. It will be maintained in the Entomological Museum of the California Academy of Sciences, Mr. Leech read excerpts from letters and field notes of early entomologists demonstrating the value of many of the documents on file. Drawings, published and unpublished, are included in the material. Photographs of entomologists and other "curiosities" were placed on exhibit.

Dr. Usinger commented on the data available in the historical files of the academy. He suggested that information on the existence of this material be published in some detail in order to increase its usefulness to interested persons.

Dr. R. L. Usinger reported on interesting habits of reduviid bugs known as resin bugs in Thailand. Kodachrome slides were shown to illustrate *Dipterocarpus* tree-holes with bugs waiting in position near the edge of the resin pools.

Jerry A. Powell showed a vial containing the remains of a caterpillar of a gelechiid moth, *Pseudochelaria manzanitae* Keifer, and some nematodes of the family Mermithidae which had destroyed it. Apparently Mermithids have never been recorded from any North American Gelechiidae. The habitat, manzanita bushes on the very dry hillsides west of Alpine Lake, Marin County, seems to present an interesting problem. Presumably the life-cycle of the worm includes a free living stage in the soil and a certain amount of moisture is necessary to facilitate the parasite's mobility in leaving the host and entering the soil. However, the larvae, which were collected June 6, 1957, normally pupate and transform by late June or early July. Therefore at a locality where one would not expect any June rain, the nematodes apparently must depend upon dew or some other unexplained source of moisture for their return to the coarse, well-drained soil. Six larvae were found infested among 40 collected at random from terminals three to four feet above the ground.

H. B. Leech reported as follows:

"On February 10, 1957, several greenish bees were noticed flying around just outside my kitchen window, in Mill Valley, California. They settled on a galvanized iron pipe to sun themselves, and stayed so persistently within reach that finally one was collected. It was not the common *Osmia lignaria* Say, but another species of the typical subgenus. In Sandhouse's revision of 1939 it keyed to *O. ribifloris* Cockerell, of which the California Academy of Sciences has only a few from California (Mokelumne Hill, Calaveras County, 'Feb.', 'Mar.', F. E. Blaisdell collector; and Altadena, Los Angeles County, also in February, C. D. Michener collector), and none from the San Francisco Bay region. Sandhouse gives merely New Mexico, Arizona, California, Oregon, and does not comment on the date of emergence.

"On February 12, 1958, my son Bill collected another male, within six feet of where mine was taken the year before. Examination shows the species to be nesting in the cracks between cedar shingles, on the south wall of the house." . . .

Mr. Leech also exhibited illustrations of the national butterfly of Japan,

Sasakia charonda Hewitson, together with Japanese stamps picturing the butterfly.

Dr. Kessel introduced a guest, Mrs. Beverly Ehreth, who is a naturalist and teacher at Novato, California, as well as director of the entomological society of the 4-H Club in her area. Dr. Kessel commented on Mrs. Ehreth's recent collection of two Jerusalem crickets which seemed abnormally sluggish. They proved to be infected with horsehair worms, class Gordiacea. Five specimens were released from one insect when it was dropped in water.

Dr. R. C. Miller presented an address on the subject of the Ninth Pacific Science Congress held at Bangkok, Thailand, from November 18 to December 9, 1957.

The first Pacific Science Congress was held in 1920 at Honolulu, where it was organized by the director of the Bishop Museum, H. E. Gregory. Since that time the congresses have been held about every four years. Eight hundred and fifty persons attended the ninth Congress, many more than anticipated. Numerous sections were held to cover fields and problems of interest to the people in and around the Pacific area. Dr. Miller noted a resolution passed at the Congress which urged establishment of a National Museum of Science in Thailand. Action is expected within a couple years. Numerous interesting color slides were shown of scenes and events covered while attending the Congress.

The meeting was adjourned to the "Coffee Social" at 9:10 p.m.—DEANE P. FURMAN, *Secretary*.

Two Hundred and Fifty-eighth Meeting

The two hundred and fifty-eighth meeting of the Pacific Coast Entomological Society was held March 15, 1958, in the Morrison Auditorium, California Academy of Sciences, San Francisco, California. President D. D. Jensen called the meeting to order at 2:05 p.m.

The following members were present: H. B. Leech, G. F. Ferris, L. M. Henry, P. H. Arnaud, Jr., S. W. Hitchcock, D. D. Linsdale, J. A. Powell, J. A. Chemsak, D. Breedlove, H. Ruckes, Jr., D. Burdick, W. W. Middlekauff, D. MacNeill, R. L. Langston, W. A. Doolin, J. G. Edwards, L. A. Ruud, Jr., W. E. Ferguson, D. M. Maddox, K. Innes, F. E. Skinner, E. L. Kessel, D. D. Jensen, D. P. Furman. Visitors were: Bruce Hudson, Ben Feingold, Thomas Leech, Barry E. Pullen, Phyllis Middlekauff, Grace MacNeill, Nora MacNeill, Daren MacNeill, Margaret M. Hanna, Karen Engelhart, Nancy Doolin, Peter Westigard, S. Smith.

The minutes of the meeting held February 14, 1958 were read and approved.

Dr. Ruckes nominated Dr. Dennis Hynes of California State Polytechnic College and Dr. Leslie Smith, of the University of California at Davis, for regular membership. He nominated S. M. Sager of the University of California for student membership. The candidates were elected unanimously to the membership categories for which nominated.

The President announced that of the two remaining meetings scheduled for the spring months one is to be held at San Jose State College and the other is to be a field day. He announced the following committee to decide

on a date and arrange for a place for the annual field day meeting: Hugh Leech, Chairman; Herbert Ruckes Jr. and Laura Henry.

Program Chairman Frank Skinner announced April 26 as the probable date for the meeting at San Jose State College. Dr. Tilden and Dr. Edwards have arranged the program for the day.

Dr. Ed Kessel described highlights of his last summer's trip to Alaska, illustrated by a series of beautiful color slides.

Bruce Hudson presented a lecture on the mass culture of fleas for production of flea-bite antigen. He is working on the project as an entomologist with Kaiser Foundation Hospital, under a grant from the U. S. Public Health Service. Dr. Ben Feingold, director of the project was also present.

Dr. Hudson mentioned the early history of flea nuisance in the San Francisco area, known as the "Puebla de las Pulgas" of the Portola Expedition. He presented color slides of immediate and delayed types of reactions in man following flea bites.

The cat flea, *Ctenocephalides felis* (Bouché), appears to be the most common flea annoying man in the bay area, but the human flea, *Pulex irritans* Linnaeus causes the most trouble by its bite.

Methods were described by which 250-500 thousand cat fleas are reared per week at the laboratory.

An interesting by-product of the investigation has been the finding that what at first appeared to be morphologically identical strains of *Pulex irritans* contain at least two, and perhaps three distinct species. These differ physiologically, among other ways, in adaptation to different hosts. The San Francisco form is the typical *Pulex irritans*, well adapted to man. It is the only one of the complex studied which has been maintained successfully on human blood.

Following a brief discussion the meeting was adjourned to the "Coffee Social" at 3:50 p.m.—DEANE P. FURMAN, *Secretary*.

Two Hundred and Fifty-ninth Meeting

The two hundred and fifty-ninth meeting of the Pacific Coast Entomological Society was held April 26, 1958, in the Science Building, San Jose State College, San Jose, California. President D. D. Jensen called the meeting to order at 2:00 p.m.

The following members were present: D. D. Jensen, W. E. Ferguson, R. F. Schoepner, W. H. Lange, F. R. Cole, J. W. Tilden, P. H. Arnaud, Jr., H. B. Leech, K. S. Hagen, P. S. Bartholomew, R. P. Allen, E. G. Linsley, H. Ruckes, Jr., D. J. Burdick, D. D. Linsdale, K. Radford, R. C. Whitney, R. L. Doult, K. P. Shea, F. E. Skinner, C. J. Worthington, W. W. Middlekauff, J. G. Edwards, D. Damiano, D. Breedlove, T. H. Lauret, D. P. Furman. Visitors were: J. P. Figg-Hoblyn, Pauline L. McMasters, Stephanie S. Ferguson, Douglas W. Price, James M. Code, Fred J. Santana, Vernon W. Nellis, Carl H. Lindroth, John Harville, David Bartholomew, May S. Drei, Joan Gerdtz, Perry Allen, Peter Westigard, Carol Radford, A. Sanchez, Myrnel Guzman, Wesley L. Bond, M. Susan Gardner, Lorraine W. Harwood, June Haslett, Julia Hoagland, Robert E. Dolphin, S. Smith, Fred Bennett, L. E. Caltogirone, Robert Kolling, Robert Fox, Roger Lasch, Ronald

S. Daniel, Albert E. Crane, R. N. Ito, David Huntzinger, Terry Seeno, Leta Rae Lauret, Homer H. Eastman, Robert V. Gauthier.

Dr. Ellis, Acting Chairman of the Department of Biological Sciences of San Jose State College, read a welcoming message from Dr. C. D. Duncan, who was absent due to illness.

The minutes of the meeting held March 15, 1958 were read and approved following correction.

Dr. J. G. Edwards nominated Mr. Terry Seeno of San Jose State College for a membership in the Society. Mr. Seeno was elected to regular membership by unanimous vote.

The President announced as winner of the best entomological collection of the Fifth Annual Bay Area Science Fair, Charles Cushner of Lincoln High School, San Francisco. His project: Coleopteran survey. His teacher: W. F. Monahan. Two other collections chosen for honorable mention were those of:

1. David Cavagnaro of Tamalpais High School, Mill Valley. His project: Preserving insect larvae. His teacher: Katherine M. Flanagan.
2. Bradford S. Perry of Vallejo Senior High School, Vallejo. His project: Lepidoptera of California. His teacher: C. G. Aldrich.

Dr. Kenneth Hagen and his committee were commended by the President for their efforts in judging the entomological exhibits at the Science Fair.

Hugh Leech announced that the annual field trip of the Society would be held May 24 at Russelman Park, Contra Costa County.

In response to the President's call for notes and exhibits Vernon W. Nellis exhibited specimens of Cerambycidae, *Necydalis barbarae* Rivers and *Necydalis cavipennis* LeConte, both species of which were collected at his home in San Carlos, California. The collection area is near the hills with nearby chaparral, eucalyptus, bay, and oak trees as well as many other plants. Four specimens of the uncommon species, *N. barbarae*, were found in mid-August of different years. The feeding place is unknown. The specimens are almost 1½ times as large as the ones described in Dr. Linsley's key to the tribe Necydalini.

David Huntzinger, of San Jose State College, exhibited a wingless tipulid collected from a snow bank at Crater Lake Park, Oregon.

Dr. J. G. Edwards discussed the collection of insects above timberline, illustrating his account with a series of beautiful color slides.

Mrs. Pauline McMasters described her work and conclusions on the question of segmentation in the head of the polychaete annelid, *Nereis*.

Dr. John Harville discussed work of the San Jose State College Field Station, with particular reference to studies on food habits of trout in California mountain lakes. An interesting series of color slides enhanced the presentation.

Dr. J. W. Tilden talked about the alpine butterfly associations at Tioga Pass, Yosemite National Park. He stressed three main points as follows:

Firstly, there are several plant associations in the vicinity of Tioga Pass and each has its own characteristic butterflies. Some associations have only one characteristic species, others have several. One aspect of the study he

hopes to make, is to map more completely the components, both plant and butterfly, of each association. As an example, the moraines near the pass are covered with white-bark pines and with several herbaceous plants characteristic of these areas. *Icaricia shasta* Edw., *Thorybes nevada* Scud., *Euphydryas nubigena* Behr and *Lycaena cupreus* Edw. are butterflies typically found there. Of course they also may be found higher in similar areas. But let one walk a few feet down into the meadows, and one finds *Plebeius saepiolus* Bdv., *Colias behrri* Edw., and other species not found in numbers on the moraines. Dr. Tilden interprets this to be due to the drainage and soil conditions, favoring the food plants of the respective butterflies.

Secondly, there is a definite succession of species during the summer. Drier areas warm up sooner. The meadows even when not excessively elevated are colder, and butterflies appear there later than they do on the drier areas. This is evident even when the dry areas are much more elevated. So we get the interesting phenomenon of elevational reversal. Butterflies are flying around the peaks before they appear in the meadows below. Each species seems to have a definite season of flight earlier or later, just as at lower elevation. This is in contrast to the usual concept of the uninitiated, who might suppose that everything comes out at the same time at higher elevations. Data as to how this succession takes place is one aim of the study.

Thirdly, the time of emergence of a given species is evidently different in different years, depending on the time the season opens up. This seems to be due to amount of snowfall, as well as temperatures leading to melting of the snow. The extent to which emergence varies in different years could be correlated with known weather for the year if sufficient data were obtained.

He added that weather data if given as daily temperature and wind velocity, might be used to show that free flight of these alpine butterflies depends on two factors: direct sunlight and wind velocity. Observation will tell you that these butterflies will cease flight when a cloud passes over the sun. Likewise they cease flight at high wind velocities. Because of the low ground temperatures, they seem more sensitive to these factors than, for instance, butterflies under desert conditions, where ground temperatures are high.

In commenting upon Dr. Tilden's talk, Dr. E. G. Linsley stated that he and Dr. J. W. MacSwain had observed the emergence of *Vanessa cardui* L. over several hundred square miles of the Mojave Desert which appeared to be the major source of the butterflies in the widespread flights in the Central Valley during the second week of April. Apparently the extensive fields of annual plants which appeared in response to suitable late autumn rainfall provided unusually favorable conditions for the build up of *Vanessa* populations. He stated that Boraginaceae were particularly subject to attack by larvae and that in many sections of the desert nearly all of the *Cryptantha* was defoliated. *Amsinckia*, *Lupinus*, and *Sphaeralcea* were also heavily attacked in local areas following defoliation of *Cryptantha*. In some places it was difficult to walk without crushing pupae. Residual populations had produced a large larval population, most of which would probably not mature because of lack of food. On the Colorado desert, evidence was found of a large but earlier emergence, perhaps a generation ahead of that on the

Mojave. During the April flights the migrating butterflies provided a definite hazard in the San Joaquin Valley because they obscured windshields. Blackbirds and English Sparrows feasted on the dead butterflies on the shoulders of the highway. The general trend of the flights was northerly or northwesterly, although the pattern varied from time to time.

Dr. Hagen and Dr. Middlekauff commented on the recent abundance of *Vanessa* in the Kettleman Hills and Marysville areas of California.

Dr. John P. Figg-Hoblyn presented an address on the interpretation of the "dual innervation" of the apterygote antenna with reference to cephalic segmentation.

Due to the absence of Dr. Duncan his address entitled "Entomology at San Jose State College," was read by Dr. Tilden. The growth of the entomology program at the college from 1930, when general entomology first was placed on its curriculum, to its current, varied offerings and facilities is indicative not only of the increasing significance of the field but also of the enthusiasm of a dedicated staff. The meeting was adjourned at 4:10 p.m. —DEANE P. FURMAN, *Secretary*.

Two Hundred and Sixtieth Meeting

The annual field meeting of the Pacific Coast Entomological Society was held at Russelman Park, Contra Costa County, May 24, 1958. The following members were present: Jane MacSwain, W. W. Middlekauff, Robert L. Langston, Jon L. Herring, John A. Chemsak, Deane Furman, Ed Swift, Hugh B. Leech, D. D. Jensen, E. G. Linsley, J. W. MacSwain, Herbert Ruckes, Jr., J. W. Tilden, Wm. A. Russell, Paul H. Arnaud, Frank E. Skinner, D. G. Denning, A. Earl Pritchard, Bill Ferguson, Donald M. Maddox, Charles Cushner. Visitors were Juanita Linsley, Kay, Lynne, Bryan and Phil Furman, Phyllis and Dave Middlekauff, William and June Simonds, Dick Gardiner, Evelyn and Ann Langston, Mrs. Jon L. Herring, Mrs. Jerry Powell, Mary Ann MacHenry, Riley and Tim Swift, Patricia and Carol Jensen, Nancy, Lyn and Ginger Ruckes, Hazel, Jimmy, Bernice and Jan Tilden, Marguerite Arnaud, David Skinner, Loretta Denning, Marie Moor, Stephanie, Rickie and Robin Ferguson, Ann and Debbie Maddox, Mary, Thomas and Bill Leech.

The pleasant, sunny afternoon was spent in picnicking, visiting with old and new friends, collecting, and enjoying the recreational facilities of the park.—DEANE P. FURMAN, *Secretary*.

Two Hundred and Sixty-first Meeting

The two hundred and sixty-first meeting of the Pacific Coast Entomological Society was held October 17, 1958, in the Morrison auditorium at the California Academy of Sciences, San Francisco, California. President D. D. Jensen called the meeting to order at 7:40 p.m.

The following members were present: E. S. Ross, O. Bryant, G. A. Samuelson, J. Gordon Edwards, Terry Seeno, W. A. Doolin, E. O. Essig, A. E. Michelbacher, Paul A. Harvey, Richard Dahl, Kenneth S. Hagen, Y. Tanada, Don Burdick, Ibrahim K. Kaddou, Paul H. Arnaud, Jr., Frank E. Skinner, Evert E. Lindquist, Jerry A. Powell, Otto W. Graff Jr., Laura M. Henry, T. S. Acker, William Russell, K. P. Shea, R. L. Doutt, J. W. MacSwain, Jane MacSwain, Herbert Ruckes, Jr., Paul D. Hurd, Jr., William E.

Ferguson, D. D. Jensen, Dick Wilkey, Edwin Cott, Dennis Hynes, W. W. Sampson, John A. Chemsak, Dennis Breedlove, W. D. Murray, Don MacNeill, J. W. Tilden, J. H. Freitag, Richard Bushing, C. J. De Mars, D. P. Furman. Visitors registering were: Edgar A. Smith, L. Caltagirone, Sterling Bunnell, M. W. Bunnell, M. Ayron, G. Pronin, David H. Huntzinger, Patricia, Carol and Anita Jensen, Nancy Doolin, Marie W. Essig, Martha Michelbacher, Kay M. Furman, Tom Leech, Ed. W. Kirschbaum, D. C. Rentz, S. D. Smith, K. W. Brown, Mr. and Mrs. R. C. Elliott, Mr. and Mrs. Peter Rubtzoff, Dorothy and Lynda Dahl, R. H. Van Zwabenburg, Mr. and Mrs. G. L. McGill, Philip S. Barker, Theo F. Watson, Barry E. Pullen, F. X. Brace, L. Brace, Margaret Cooper, Maxine Lindquist, Frances C. Powell, Anne Graf, G. J. Haughey, M. Haughey, Elsa P. Russell, Ricky and Jeff Douth, Ralph J. Black, Art Smith, Lois B. McNally, James H. McNally, Keith A. Scott, Jen Scott, Jeanette and Calvin Rogers, Catherine Tosski, Mrs. W. D. Murray, Nancy MacSwain, Mrs. C. G. Noack, John MacSwain, Elias Tuma, Paul Kraemer, George P. Willsey, Gerard M. Thomas, David L. Wood, Glenn Kissinger, Doris Fujimoto, Judy Yamada, Ron Hall, John E. Henry, Melora Hilbert, Leon Spreyer, P. Watson, Dick Halbert, Richard H. Whitsel, Fred J. Santana, Dorothy De Mars, Kathleen Conrey, David Bettencourt, Onkar Singh Bindra, K. R. Thakare, R. Toschi, Nancy Ruckes, Grace Hurd, Kathryn Hurd, W. W. Allen, Frank B. Hicks, Stephanie Ferguson, Mrs. R. F. Wilkey, José Rutilio Inezada, Woody Hilbert, D. Giuliani.

The minutes of the meetings held April 26 and May 24, 1958 were read and approved.

The President announced appointment of a Nominating Committee to select a slate of nominees for officers for 1959. The committee consisted of Dr. Kenneth Hagen, Chairman; Dr. E. S. Ross and Dr. J. W. Tilden. He also announced the appointment of an Auditing Committee composed of Dr. E. L. Kessel, Chairman; Dr. J. W. MacSwain and Dr. J. Gordon Edwards.

The President reported the death of one of the Society's most valued members, Professor G. F. Ferris. A special issue of the *Pan-Pacific Entomologist* is to be devoted to the memory of Professor Ferris.

Laura Henry announced that contributions are still being accepted for the Gordon F. Ferris Memorial Fund, which will be used to provide a scholarship in entomology.

Mr. H. B. Leech stated that Mrs. Ferris has donated drawings and other items of interest to the Society's historical file. The Society owes thanks to Mrs. Ferris for her generosity.

Dr. Ed. Smith, who recently returned from Indonesia, announced that twenty to thirty foreign service positions are available for medical entomologists. Entomologists, either with or without previous field experience, are being considered. The program is sponsored by the International Cooperation Administration.

Dr. Ruckes nominated the following individuals for membership in the Society:

Leopoldo Caltagirone, Entomology student from Chile, currently at the University of California.

F. F. Bibby, Arizona Fertilizer Company, Phoenix, Arizona.

Dr. George D. Butler, Jr., Dept. of Entomology, University of Arizona.
Mr. Van Zwahlenburg, retired entomologist of the Hawaiian Sugar
Planters' Association, now residing in Santa Rosa, California.

Dr. Edwards nominated for membership:

Mr. David H. Huntzinger, student at San Jose State College.

The nominees were elected unanimously to regular membership.

In response to the President's call for notes and exhibits Dr. Doult described the life history of a gall wasp which has an alternation of generations. This is the first proven case of heterogony among California cynipids and was worked out simultaneously, independently, and without knowledge of the other's research by Mr. Robert Lyons of Los Angeles City College and Dr. Doult.

The species is *Dryocosmus dubiosus* (Fullaway). It produces a bisexual generation in early spring which develops in the male aments of the black oaks. The mated females oviposit in the veins of the leaves. The eggs are slow in hatching for the first larvae appeared only after two months and some eggs were found to be viable and to hatch as long as six months after deposition. Dr. Doult found that unlike other Hymenoptera the unfertilized eggs of this species do not develop parthenogenetically, and he suggests this may be unique.

The galls produced on the leaves are bicornate and from them emerge a uni-sexual generation of females. Dr. Doult found these to be of two types: one type produces female progeny only, whereas the other produces males exclusively. The wasps from these leaf galls were originally described as a distinct species in a separate genus, and the present biological study shows they must now be synonymized with *D. dubiosus* which has priority. Dr. Doult objects to the use of trinomials to designate alternate generations, and furthermore believes that the common usage of the terms sexual and agamic generations is erroneous for the agamic generation is really sexual. He would propose that the binomial be used and then followed by an appropriate designation of either bisexual or unisexual generation which is both descriptive and accurate.

Mr. Hugh B. Leech stated that in the minutes of the 232nd Meeting of this Society, he recorded *Stator limbatus* (Horn) as occurring in some numbers at Lucerne, Lake County, California, in August, 1953 (Proc. Pacific Coast Ent. Soc., in Pan-Pacific Ent., 30 (1):85-86. 1954). In mid-August, 1959, he and his family were camping on the grounds of Cottage City Resort at Lucerne. Adults of *S. limbatus* were flying in numbers during the heat of the day, and annoying people by settling on them. The beetles were almost as persistent as small flies, and two of those which got on his skin gave an appreciable nip with their mandibles. Seed pods were maturing on adjacent black acacia trees (*Acacia melanoxylon* R. Br.) at the time, and the bruchids were readily obtained by jarring branches. It was difficult to get even fifty per cent of those knocked onto a beating sheet, though, because they took flight almost as they landed.

Dr. J. W. Tilden noted that the summer season was longer this year at high elevations in the Sierra Nevada as compared with the same season of the preceding three years (1955, 1956, 1957). Whereas in 1957 no insects

were flying after September 1, in the same area above Tioga Pass, Yosemite National Park, this year many insects were flying on September 3.

Of particular interest was the presence of several specimens of *Parnassius clodius baldur* Edwards. This insect normally flies earlier in the season and at much lower elevations. On September 3, 1958, it was flying at an elevation of 11,000 feet, in the Alpine Fell-fields Association, an area where *Parnassius smintheus behrii* Edwards is normally found in July and August. This elevation is not the usual habitat of *P. clodius*.

Mr. D. H. Huntzinger exhibited two *Cimex pilosellus* (Horv.) and four *Basilia forcipata* Ferris, taken from *Myotis* species collected in Oregon Caves National Monument, September 8, 1958. He also noted the collection of one *Silpha surinamensis* Fabricius taken at Crater Lake National Park on September 4, 1958, under a deer carcass. This eastern species of Silphidae may be a new record for Oregon.

J. G. Edwards displayed a specimen of the brilliant green buprestid, *Trachykele opulenta* Fall, which was collected by Mrs. Vaughn in Cambria, California. Ecological data are not yet known concerning this specimen, but it is believed that this is a significant extension of the known range of this species.

Edwards also displayed a reduviid of the genus *Triatoma* which had hospitalized a San Jose rancher the previous week with severe nausea, widespread rash, dizziness, and so forth. When he returned home he found the bug resting beneath his pillow. It feigned death for two days but when heated on the stove it jumped into action and was as lively as a spider. When it cooled, it again feigned death, for two more days, until heated again. This procedure has been repeated again, but the specimen now is "looking dead" again.

Dr. Usinger commented on bites of *Triatoma* in California. He stated that in an average year about four such cases of severe reaction to the bites of the bug are reported. The severity of reaction seems associated with increasing sensitivity following successive bites.

Dr. E. S. Ross next presented the main address of the evening, dealing with his recent extensive collecting trip in Africa. His major research interest, study of the insect order Embioptera, requires personal collection and observations in the major tropical regions of the world. Photographic records of the natural history of these areas, particularly that concerned with insects, has become a major by-product of the research. Dr. Ross described highlights of his 26,000 mile trip through Africa. Ample evidence of the endless opportunities for filming little known fauna and flora of the area was presented in the form of a series of wonderful color slides.

The meeting was adjourned to the "Coffee Social" at 10 p.m.—DEANE P. FURMAN, *Secretary*.

Two Hundred and Sixty-second Meeting

The two hundred and sixty-second meeting of the Pacific Coast Entomological Society was held December 13, 1958, in the Morrison Auditorium at the California Academy of Sciences, San Francisco, California. President D. D. Jensen called the meeting to order at 1:10 p.m.

The following members were present: R. L. Doult, Herbert Ruckes, Jr.,

D. P. Furman, D. D. Jensen, F. E. Skinner, E. L. Kessel, P. D. Hurd, Jr., R. L. Usinger, E. O. Essig, K. S. Hagen, J. H. Freitag, R. W. Thorpe, D. D. Linsdale, E. E. Lindquist, J. A. Powell, J. W. MacSwain, T. S. Acker, R. L. Langston, J. W. Tilden, W. D. Murray, L. E. Caltagirone, P. H. Arnaud, Jr., C. D. MacNeill, C. Cuschner, P. A. Harvey, D. J. Burdick, W. A. Doolin, A. E. Pritchard, J. A. Chemsak, E. S. Ross, M. Wasbauer, R. C. Miller. Visitors registering were: H. Ruckes, Sr., John MacSwain, James Milstead, Derham Giuliani, Woody Hilbert, H. Bikler, K. W. Brown, Marshall Reed, Nancy Doolin, Jack R. Powers.

The minutes of the meeting held October 17, 1958 were read, amended and approved.

Dr. Ross announced that Mr. Owen Bryant, a long time member of the Pacific Coast Entomological Society, passed away late in October of this year and left the bulk of his estate to the California Academy of Sciences for the benefit of the Department of Entomology. This included the remaining portions of his insect collection and library as well as an endowment fund. Prior to his death Mr. Bryant had already donated a large part of his insect collection to the California Academy of Sciences.

Dr. H. Ruckes, Jr., proposed the following nominees for membership in the Society: Woody Hilbert, Derham Giuliani, Jack R. Powers, Robin Thorpe, C. E. Kennett. They were elected by unanimous vote to full membership.

President Jensen announced that Mr. Van Zwahlenburg had been appointed to fill the vacancy in the Publication Committee left by the death of Professor Ferris. Dr. J. Gordon Edwards was appointed as a member of the Special Committee on Nomenclature, and Dr. Usinger was appointed chairman.

The Chairman of the Auditing Committee, Dr. E. L. Kessel, reported the books of the Society were found to be in order.

In response to the President's call for notes and exhibits, Jerry A. Powell exhibited specimens of an unusual tortricid moth, *Synnoma lynosyrana* Walsingham. The species shows remarkable sexual dimorphism which is a very aberrant characteristic among the Tortricidae. The females, having a very large abdomen, seem unable to fly successfully. The genus and the monotypic species were described from specimens collected in 1871 on the plains northeast of Mt. Shasta by Lord Walsingham. The species has subsequently been reared from *Chrysothamnus* from the same area and at least as far north as southern Idaho. The specimens shown were reared from larvae collected on both *Chrysothamnus nauseosus* and *C. viscidiflorus* near Weed, Siskiyou County, California in August, 1958. The larvae live in tough, silken tubes and are often so numerous that they draw up the branches of the host plant into conspicuous bundles. Also shown were the black egg patches of the species which had been laid in late September. Some of the eggs had hatched, but it was suggested that this was probably due to the laboratory conditions, as the larvae died without constructing hibernaculi.

Dr. J. W. Tilden exhibited the larva of a fly of the genus *Microdon*, family Syrphidae, that had been taken by Paul Shafer, a student at San Jose State College. The larva was collected on November 28, 1958, from under the bark of a decayed stump of ponderosa pine, in an area that had

been timbered over about fourteen years ago. The locality was three miles below Georgetown, El Dorado County, California, at an elevation of 2300 ft.

Donald J. Burdick and Marius Wasbauer presented the following paper entitled, Provisioning behavior of *Methocha californica* Westwood.

"The only previous biological note concerning *Methocha californica* Westwood was presented in 1912 at the 46th meeting of this society. At this meeting J. C. Bridwell in a commentary on some rare and little known Hymenoptera, which he had collected, mentioned that the species was 'parasitic in the burrows of tiger beetles.' The first account of *Methocha* as a cicindelid parasite was by Adlerz in 1903 when he observed a female of *M. ichneumonides* Latreille successfully attack and paralyze a large tiger-beetle larva. Since this time a number of observations on this and other species have been reported and in each case a cicindelid larva was used as prey.

"Our observations were made on two females collected by J. Powell and Burdick as they crossed the nesting site of a species of a sphecid which they had under observation. After establishing *Omus californicus* Eschscholtz larvae, admittedly abnormal hosts, in observation burrows, a *Methocha* female would be placed in the jar and watched while she searched, found, paralyzed and oviposited on the *Omus* larva. In all, twelve larvae were paralyzed and eleven eggs were laid by the two *Methocha* females. When first dropped into the jar, the female, moving rapidly and randomly, investigated any depressions or burrows that she came across. Upon finding the occupied burrow, she pointed her antennae down into the burrow and became quiescent. Usually she would then move to the side of the burrow that the host's mouthparts were on and would walk down the burrow toward the host. This orientation placed the female in position to reach the ventral part of the host's neck with her sting. The *Omus* larva, by this time aware of the intruder, had prepared itself to strike. The approach of the *Methocha* was very rapid, and she was able to place at least her first two pairs of legs on top of the flat shield formed by the head and prothorax of the host before the larva lunged upward, raising its head and closing its mandibles upon its attacker. At this time, the female dropped her abdomen down, and the mandibles of the *Omus* closed harmlessly around the wasp's narrow waist. In this position, the female stung her host in the neck, temporarily paralyzing it. She then lifted her abdomen through the now inactive mandibles of her host and climbed out of the burrow. Here she wandered about for a short time and then reentered the burrow and began preparing the host for oviposition.

"After the initial sting delivered by the female *Methocha*, the tiger beetle larva was usually rendered immobile. However, there was some variation in the degree of paralysis. The paralysis was of a very temporary nature, and in most cases eighty to ninety percent mobility was regained by the *Omus* larva within 24 hours.

"Following the initial sting and paralysis of the prey, there was always a secondary stinging response which was altogether different from the first. The female *Methocha* oriented herself so that she faced the venter of the

prey within the burrow, grasped one of the fore or mid coxae in her mandibles, curled her entire body upwards and around and stung the *Omus* larva in the membranous area just behind the head capsule. This was repeated an average of four to five times during the course of a provisioning cycle. We found that we could increase the number of subsequent stings merely by moving the *Omus* larva in the burrow. Apparently movement on the part of the host incited the stinging response.

"After the host larva was stung into quiescence, the wasp engaged in host feeding. She accomplished this by maxillating the venter in the neck region or at the base of one of the coxae. When she succeeded in puncturing the skin she then fed on the exuding blood.

"In preparing the larva for oviposition, the wasp tilted the head capsule of the prey back by pushing it with her head. She then climbed up and grasped the head capsule with her fore and middle legs, moving her abdomen around until it contacted the hind coxa of the host larva. The abdomen was then moved back and forth several times and the egg extruded. The egg was always placed mesally at the base of the hind coxa and its position was relatively constant. This constancy is understandable when we consider that the prey recovered rapidly and was able to move about in the burrow. In this position the egg was relatively safe from being crushed or dislodged.

"After oviposition, the wasp began to fill the burrow, usually first by prying material loose from the upper sides of the burrow with her mandibles and then walking out of the burrow to search for pieces of material of suitable size, which she carried in her mandibles and placed on the cephalothoracic shield of the prey. We noted no raking of material with the front legs, a trait characteristic of so many aculeate wasps.

"The egg hatched in from four to five days and the first instar larva remained in the same position as the egg had been, feeding suctorially on the body juices of the host. This suctorial feeding continued up to the time of death of the host, in about ten to twelve days. By this time, the *Methocha* larva was quite large and moved about freely, often feeding inside the body of the dead *Omus* larva. The active larval period of the parasite was completed in twelve to fifteen days. Two of the larvae formed cocoons. The adults will probably not emerge until next spring."

The talk was illustrated by a series of excellent color slides.

Dr. Hagen, as Chairman of the Nominating Committee, announced that the following members had been nominated for officers for 1959: R. L. Doutt, President; R. M. Bohart, Vice-President; D. P. Furman, Secretary; R. C. Miller, Treasurer. No further nominations were received from the floor. The nominees were unanimously elected to office.

President Jensen turned over the chairmanship of the meeting to incoming President Doutt.

Dr. Jensen delivered the Presidential address entitled "Insects—Both Hosts and Vectors of Plant Viruses." The text of his stimulating address is to appear as a separate paper in the *Pan-Pacific Entomologist*.

The meeting was adjourned to the "Coffee Social" at 3:40 p.m.—DEANE P. FURMAN, Secretary.